Will you look at me? Social anxiety, naturalistic social situations, and wearable eye-trackers

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CHAPTER 6

Main findings and general discussion

The main goal of this dissertation was to shed light on the nature of gaze behavior adopted by socially anxious individuals in social interactions. To ensure precision of measurement in naturalistic social situations – including public speaking situations and face-to-face conversations – we took advantage of state-of-the-art wearable eye-trackers (Tobii Pro Glasses 2) to investigate gaze behavior in socially anxious individuals. Specifically, this dissertation sought to address three questions: (1) Whether social anxiety is featured by gaze avoidance. (2) Under which conditions socially anxious individuals display gaze avoidance. (3) To what extent subjective experience of gaze avoidance corresponds with actual gaze behavior. The main findings pertaining to the three questions are summarized below.

MAIN FINDINGS

Is social anxiety associated with gaze avoidance?

The results from the review (*Chapter 2*) suggest that there is not a simple 'yes or no' answer to this main question, and that the relation depends on three factors: severity of social anxiety, type of social situation, and development. In particular, gaze avoidance is consistently observed in adults with SAD across various experimental paradigms, whereas, in adults with high levels of social anxiety but no diagnosis (HSA), comparatively consistent evidence for gaze avoidance is observed in social-*evaluative* situations. Based on these findings, the following experimental studies (*Chapters 3-5*) focused on nonclinical samples, and provide additional evidence for face gaze avoidance by HSA people in social-evaluative situations. Altogether, the results of this dissertation point to both robustness and complexity of the relationship between social anxiety and gaze avoidance.

What situational factors influence gaze behavior?

As concluded in *Chapter 2*, adults with SAD exhibit gaze avoidance across three types of situations: face-viewing tasks, speaking tasks and social interactions, whereas HSA adults display gaze avoidance in speaking and interaction tasks but not in face-viewing tasks; however, up till this point direct empirical evidence for such situational specificity was lacking. *Chapter 3* fills this gap by comparing a face-viewing task and a public speaking task - using identical stimuli - within the same sample, and provides support for the assumption that decreased fixation on faces of the audience in HSA individuals was evident during the speaking task and *not* during the face-viewing task. In order to further demonstrate that gaze avoidance occurs in naturalistic social-evaluative situations for HSA people, we extended the video-based speech context to live, face-to-face getting-acquainted interactions (*Chapters 4 and 5*). In particular,

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Chapter 4 developed a conversation wherein a participant and a confederate took turns sharing more or less personal information. The findings corroborate that, in naturalistic social-evaluative situations that require reciprocal self-disclosure, face gaze avoidance does occur in HSA individuals.

Correspondence between perceived and actual gaze avoidance?

The third question is answered in *Chapter 5*. We evaluated whether perceived gaze anxiety is associated with actual gaze avoidance as well as the relative contributions of gaze anxiety and social anxiety to gaze avoidance. The results reveal that gaze anxiety is significantly associated with reduced face gaze during speaking phases (not listening phases) in a conversation. Moreover, gaze anxiety does not make an additional contribution to social anxiety in predicting face gaze behavior. Altogether, our findings suggest that gaze anxiety does predict actual gaze behavior during a face-to-face initial encounter, but social anxiety is a stronger predictor.

GENERAL DISCUSSION

Face gaze avoidance: HSA and real-life interactions

One of the most important findings from this dissertation is that individuals with high levels of social anxiety generally displayed face gaze avoidance in naturalistic social situations. The findings are consistent with longstanding clinical observations (American Psychiatric Association, 2013) and theoretical models (e.g., Clark & Wells, 1995; Hofmann, 2007), but also concordant with other recent eye-tracking studies conducted in naturalistic settings (Chen et al., 2015; Dechant et al., 2017; Haensel et al., 2020; Hessels et al., 2018; Howell et al., 2016; Kim et al., 2018; Rubo et al., 2020). Therefore, this dissertation contributes to the literature by strengthening the notion that gaze avoidance is a behavioral maker of social anxiety, as well as by demonstrating that such avoidance occurs in real-life social interactions.

The results that face gaze avoidance was observed in HSA people converge with other studies that involved nonclinical samples (Dechant et al., 2017; Haensel et al., 2020; Hessels et al., 2018; Howell et al., 2016; Rubo et al., 2020). It suggests that face gaze avoidance already exists in those experiencing greater social anxiety from the general population. Our results thus support the continuum model of social anxiety rather than categorical differences between patients and non-patient populations. On the other hand, what differentiates people with HSA and SAD, based on the findings from *Chapters 2 and 3*, appears to be whether they exhibit gaze avoidance in face-viewing tasks. People with SAD tend to display gaze avoidance while being asked

to look at a facial picture (*Chapter 2*) whereas people with HSA do not (*Chapters 2 and 3*). One possible explanation is that SAD gives rise to problems with flexible gaze patterns in response to changing social situations, which in turn may lead to overall avoidance of faces. In contrast, flexibility in people with HSA is possibly less impaired than in patients, resulting in situation-dependent rather than overall avoidance when confronted with faces. Intriguingly, the experimental work in this dissertation highlights flexibility of gaze behavior in HSA people, which is discussed in the **Naturalistic situations** section below.

Moreover, results from *Chapters 4 and 5* showing that face gaze avoidance in socially anxious individuals occurred in live, face-to-face interactions with another person are in line with a recent study by Haensel et al. (2020), in which Japanese (not British/ Irish) participants with elevated social anxiety showed decreased face gaze while introducing themselves to their conversation partner. The results converge to indicate that face gaze avoidance as a behavioral maker of social anxiety could be translated to real-life interactions, and thus it means that adverse effects of eye contact avoidance are likely to occur in everyday social life for this population. As such, gaze avoidance may be a risk factor for maintaining and even exacerbating social anxiety symptoms ultimately moving towards clinically significant symptoms (Clark & Wells, 1995; Rapee & Spence, 2004).

Naturalistic situations: Mechanism underlying gaze avoidance in social anxiety

The studies included in this dissertation clearly illustrate that situational factors play an important role in the relation between social anxiety and gaze avoidance. Gaze avoidance was observed in some situations but not others. First of all, people higher in social anxiety displayed gaze avoidance in naturalistic social situations, including public speaking tasks and social interactions with others (*Chapters 3 to 5*), but not in face-viewing situations (*Chapter 3*). The absence of gaze avoidance in face-viewing tasks (*Chapter 3*) mirrors results from a number of studies using face-viewing paradigms where non-clinical socially anxious samples were involved (see *Chapter 2* for a discussion). Secondly, when engaging in actual social interactions, gaze avoidance was found across a 20-minute conversation requiring reciprocal self-disclosure (*Chapter 4*), and in the early stage of the conversation when socially anxious people were speaking (but not when they were listening, *Chapter 5*).

These results suggest that HSA individuals do not invariably avoid looking at facial stimuli; these people are sensitive to certain situational components, thereby leading to flexible gaze behavior. Indeed, recent work has also captured such context-related flexibility of gaze behavior in non-patient samples (Dechant et al., 2017; Haensel

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et al., 2020; Rubo et al., 2020; Vriends et al., 2017). For example, using video-mediated conversations with a confederate, Vriends et al. (2017) demonstrated that high socially anxious individuals exhibited significantly increased gaze towards themselves (i.e. self-focused attention) when the confederate was critical of them and decreased gaze towards themselves when they were actively involved in asking questions compared to low socially anxious individuals. While no difference was observed when the confederate initiated a conversation about general topics nor when the confederate interacted with the participant in a friendly way. Moreover, Dechant et al. (2017) reported that socially anxious people specifically avoided gazing at the eyes of avatars they interacted with when they had to make a request but not when they answered arithmetic questions. Additionally, partly in line with the findings of *Chapter 5*, Haensel et al. (2020) found that greater social anxiety was associated with reduced face gaze only at early stages of a face-to-face conversation and only when the participant was talking to the confederate (cf. *Chapter 5*).

Taken together with the current findings, the observed flexibility suggests that merely being looked at by other people may not be sufficient for gaze avoidance. Rather, the risk of being (negatively) evaluated or rejected as perceived by HSA people seems to be the key factor to elicit gaze avoidance. This may also explain why the findings in this dissertation (*Chapters 4 and 5*) were (slightly) different from those of Haensel et al. (2020). In the study by Haensel et al. (2020), the association between social anxiety and face gaze disappeared as the conversation progressed. In the present studies, face gaze avoidance was not only observed in an initial stage (*Chapter 5*) but also across the approximately 20-minutue conversation (*Chapter 4*). This could be explained by the constant risk of negative evaluation posed by the reciprocal self-disclosure task. Therefore, in line with accounts of social anxiety highlighting fear and avoidance of scrutiny by others as key features (e.g., APA, 2013; Rapee & Heimberg, 1997), results from our studies underscore that a perceived risk of evaluation or rejection has more influence on gaze behavior of HSA individuals than merely being observed.

Furthermore, our studies indicate that a demand for self-disclosure – i.e. revealing personal information to other people (Jourard, 1971) – could be a key element contributing to the perceived risk of negative evaluation, thereby resulting in face gaze avoidance for people with HSA. In line with this idea, socially anxious individuals have been shown to decrease their self-disclosure levels during social interactions when they are expecting to be liked (Voncken et al., 2020). As such, increasing demands on HSA people to reveal themselves to others is likely to place them at an increased perceived risk of receiving negative evaluation or rejection. Further, it is worth noting that our studies suggest that both immediate self-disclosure demands (e.g., speech tasks, *Chapter 3*), and social interactions where (reciprocal) self-disclosure is

explicitly expected (e.g., initial encounters involving high intimate topics, *Chapter 4*), seem to similarly lead to gaze avoidance in HSA individuals. This may provide design recommendations for creating naturalistic settings investigating gaze behavior in social anxiety.

In addition, our results showed nuanced differences in gaze behavior modulated by conversational role and intimacy within social interactions (*Chapter 4*). For example, during the prolonged conversation with a live conversation partner about low and high intimate topics, HSA people apparently perceived a higher risk of negative evaluation for low intimate topics than low socially anxious (LSA) people. Both people with high and low social anxiety appeared to perceive risk of negative evaluation with high intimate topics. LSA people may have experienced a higher level of anxiety than usual while sharing highly personal information, because having a live, face-to-face interaction with others was rare for all participants under the circumstance of COVID-19 pandemic. These results therefore emphasize the importance of establishing naturalistic situations to study gaze behavior in social anxiety, while taking real-world complexity and richness of social tasks into account.

Face gaze avoidance: Gaze anxiety, but social anxiety is a better predictor

Chapter 5 provided initial evidence that self-reported gaze anxiety, using the Gaze Anxiety Rating Scale (GARS), can partially predict actual gaze avoidance. Of note, the results indicate that gaze anxiety is of limited correspondence with actual gaze behavior. The limited correspondence may be due to people not being fully aware of their own gaze behavior. It makes sense given that gaze to faces is highly context-dependent and interactive by nature (Hamilton, 2016; Hessels, 2020). Also, because making eye contact is prescribed by (implicit) social norms, it is likely that people only have a general impression of whether or not they adhere to this norm in everyday life. Future research could clarify the extent to which the general impression fits with specific social situations.

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It is worth noting that social anxiety, compared to gaze anxiety, is a better predictor of actual gaze avoidance (*Chapter 5*). This finding seems in line with the view that gaze anxiety is an important symptom of social anxiety (e.g., Domes et al., 2016; Judah et al., 2019), suggesting that gaze avoidance is a feature that applies to people who are socially anxious individuals in general rather than to a subgroup of socially anxious people who specifically have problems making eye contact. Given that our sample was not drawn from a clinical population, replications are needed to investigate the possibility that the GARS fits in better with SAD patients. In addition, we could not rule out the alternative possibility that the relation between gaze anxiety and gaze avoidance may be specific to certain social situations, since the association between

gaze anxiety and gaze avoidance found in *Chapter 5* was only evident while taking not while listening. Further research using naturalistic social contexts therefore is needed to clarify the relationship.

Clinical implications

First, the results from this dissertation suggest that face gaze avoidance could be a quantitative and reliable indicator for the early detection of socially anxious individuals who may be at risk for developing SAD. Further, although our findings offer a promising starting point for investigation into gaze behavior in a naturalistic manner via using wearable eye-trackers, using eye-tracking for clinical purposes cannot yet be conclusively recommended as the current studies did not involve a clinical population. Few efforts have been made to seek for possibilities to apply eye-tracking as a screening tool, such as for autism spectrum disorder (e.g., Frazier et al., 2018; Kou et al., 2019). However, until the present, to the best of our knowledge, only one study attempted to use eye-tracking (in a virtual environment) as a screening tool for social anxiety (Dechant et al., 2017). This study yielded encouraging support for the application of eye-tracking to distinguish between high and low socially anxious individuals, but still, no clinical samples were involved. There is a clear need for further research, since several important questions remain to be clarified, such as: to what extent face gaze avoidance is shared by HSA and SAD, which combinations of eye-tracking paradigms (e.g., stimuli and social contexts) and gaze measures (e.g., fixations, scan patterns) is the most predictive of HSA and/or SAD. Of note, we acknowledge that social anxiety (disorder) is more than problems with making eye contact, and hence this SAD risk marker may assist clinical practice, but surely should be used in conjunction with other diagnostic techniques.

Second, targeting gaze avoidance in (early) interventions could be beneficial. Prior work indicates that high socially anxious people feel the most anxious when they are being required to make less eye contact during social interactions (Langer et al., 2013). Demonstrating this undesirable outcome in an intervention may be a straightforward way for enabling these people to remedy this apparently unhelpful gaze pattern. In addition, our findings that socially anxious individuals show gaze avoidance in situations demanding self-disclosure may carry implications for exposure exercises. For instance, encouraging socially anxious individuals to reveal more information about themselves could help create more challenging exposure exercises. In addition, asking for self-disclosure by SAD patients may be useful to treatments targeting fear of negative evaluation in SAD. For example, in an attempt to improve efficacy of virtual reality exposure therapy in reducing such fear, Kampmann (2018) proposed to add facial expressions and/or dialogues that deliver explicit negative evaluation.

Our results complement these recommendations by indicating that incorporating demands for self-disclosure into exposure exercises could also be beneficial.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The limitations and strengths of the dissertation clearly call for future research to move the field forward. Here, we discuss three promising research lines that may contribute to better understanding of gaze behavior in social anxiety.

The first is the line focusing on improving and extending wearable eye-tracking based interaction paradigms. There are several branches to pursue. (a) Measuring *eye* gaze instead of face gaze could be more theoretically relevant, although individuals seem to perceive direct gaze on their faces as eye contact in general (Rogers et al., 2019). Of note, calibration performed with multiple points and a short interpersonal distance are needed to achieve sufficient precision to measure eye gaze. (b) Although confederates' eye movements were registered during the interactions, we were not able to incorporate it in the present studies due to time constraints. Given (mutual) eye contact is a two-way phenomenon, analyzing dual eye-tracking data enables to consider the influence of both interaction partner's gaze. Further, dual eye-tracking paradigms allow to investigate when and how mutual eye contact starts, continues, and is broken across time. These subtle processes in relation to eye contact could be important to modulate or alter social consequences, such as perceived likability and social skills of socially anxious individuals by interaction partners. Collectively, these details can enrich the picture of social anxiety and gaze behavior by adding extra layers to the aggregate fixation based-gaze measures that are commonly used. (c) The interactive situations we used are restricted to initial conversations with same-sex peers. In order to gain a better understanding of how social anxiety shapes gaze behavior in the real-world, future investigations may extend to situations that capture more variety of social situations (e.g., romantic relationship initiation, group conversation), richness of social tasks (e.g., playing games, cooperation and competition), and variants in interaction partners (e.g., close friends, family members). (d) The final branch could be to test and refine our tentative hypothesis that perceived risk of negative evaluation acts as the main driver for gaze avoidance in socially anxious individuals. The main question - the extent to which this risk elicits gaze avoidance in socially anxious individuals - could be a useful starting point.

The second line is to focus on demographic characteristics as well as longitudinal changes in relation to gaze behavior. (a) Our studies exclusively involve female emerging adults mostly from Western countries. Future studies evaluating effects of

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age, gender as well as cultural background may assist clarify the extent to which these factors modulate gaze avoidance in socially anxious individuals. For instance, findings from Haensel et al. (2020) suggest that social anxiety has impact on Japanese but not British/Irish people' face gaze behavior in a face-to-face conversation. (b) It is important to note that studies from developmental perspectives are still sparse. Our review (*Chapter 2*) suggests that adolescence is a key stage for the emergence of gaze avoidance, but it has not yet been empirically confirmed. Furthermore, it still remains unclear whether individuals showing gaze avoidance are indeed more vulnerable to developing SAD later on. Longitudinal research is needed to examine the predictive validity of gaze avoidance, which may thus prove important for early detection and intervention.

The direction of the third line lies in increasing involvement of socially anxious individuals in the research processes. Gaze patterns in social anxiety have almost exclusively been examined using objective and quantitative approaches. Information generated from the perspectives of socially anxious people themselves should be valuable to understand when and how avoidant gaze patterns have developed, and which unintended consequences are experienced. Also, qualitative data that capture more detail and complexity regarding gaze behavior in socially anxious individuals can help develop effective (self-report) techniques for detection and intervention. Therefore, qualitative research, such as interview-based approaches, enables in-depth investigation of day-to-day experience and seems a promising line of research.

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