

Anton Valojää

**THE EFFECT OF SENSORY-PROCESSING  
SENSITIVITY ON SOCIAL PREFERENCE FOR ONLINE  
INTERACTION AND ASSOCIATED OUTCOME ON  
PSYCHOLOGICAL WELLBEING**



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## ABSTRACT

Valojää, Anton

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Supervisor(s): Helfenstein, Sacha; Kujala, Tuomo

Previous studies suggest that some individuals prefer social interaction via Internet over face-to-face interaction. Several studies have been conducted on the relationship between individual differences in personality or psychological distress, and social preference for online interaction, but the results have been ambiguous. The objective of this thesis was to investigate whether sensory-processing sensitivity can explain the social preference for online interaction and if the Internet should be considered an alternative, beneficial interaction channel for highly sensitive persons (HSPs). It was presumed that the HSPs might prefer the Internet as a social environment because of its lower sensory load, slower tempo of interaction and because of the familiarity of physical environment. A structured web-survey (N = 362) was conducted to answer the research questions. It was discovered that the HSPs preferred the Internet as a social medium at the expense of time spent in face-to-face interaction, but their important relationships did not take place in the Internet more than those of the non-HSPs. There was no association between better psychological wellbeing and social preference for the Internet among the HSPs, but it remained unclear whether this preference might be linked to a decrease in wellbeing. It seemed that the Internet as an environment enabled the HSPs to be less shy and more sociable than they were in face-to-face interaction. There were no differences between the HSPs and the non-HSPs regarding preferred communication modalities while online, which made it difficult to solve whether it was just the sensory-processing sensitivity that actually explained the social preference for the Internet. It should be taken into consideration that psychological distress and sensory-processing sensitivity were associated and therefore it remains unclear whether sensory-processing sensitivity or psychological distress is the underlying reason for the observed preference.

Keywords: Internet, mental wellbeing, personality, sensitivity, social interaction

## TIIVISTELMÄ

Valojää, Anton

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Ohjaaja(t): Helfenstein, Sacha; Kujala, Tuomo

On havaittu, että jotkut ihmiset viettävät mieluummin aikaa ihmisten kanssa Internetissä kuin kasvotusten tapahtuvassa vuorovaikutuksessa. Useiden yksilöllisten seikkojen, kuten persoonallisuudenpiirteiden ja psyykkisten vaikeuksien vaikutuksia tähän on tutkittu, mutta tulokset ovat olleet ristiriitaisia. Tässä tutkielmassa selvitettiin sitä selittääkö aistiprosessoinnin herkkyys Internetiin painottuvan sosiaalisuuden suosimista ja sitä, voidaanko Internetiä pitää vaihtoehtoisena, hyödyllisenä vuorovaikutuskanavana aistiprosessoinniltaan herkille. Aistiprosessoinniltaan herkkien oletettiin suosivan Internetiä vähäisemmän ärsykekuorman, vuorovaikutuksen hitaamman tempon sekä fyysisen käyttöympäristön tuttuuden vuoksi. Tutkimus suoritettiin Internetin kautta jaettuna kyselynä (N = 362). Havaittiin, että herkkät suosivat ajallisesti Internet-sosiaalisuutta kasvokkain tapahtuvan vuorovaikutuksen kustannuksella, mutta heidän tärkeät ihmissuhteensa eivät sijoittuneet Internetiin enempää kuin muillakaan. Internetin suosiminen ei ollut yhteydessä parempaan psyykkiseen hyvinvointiin herkillä, mutta ei ole tietoa siitä onko se yhteydessä huonompaan. Havaittiin, että Internet mahdollisti herkille ympäristön, jossa he olivat vähemmän ujoja ja enemmän seurallisia kuin Internetin ulkopuolella. Herkkien ja ei-herkkien väliltä ei löydetty eroja erilaisten netinkäyttötapojen suosimisessa, joka vaikeutti tulkintaa siitä, onko Internetin suosimisen syynä juuri herkkyys. On huomioitava, että aistiprosessoinnin herkkyys ja psyykinen huonovointisuus olivat yhteydessä toisiinsa, joten ei ole mahdollista tehdä selviä päätelmiä siitä selittääkö juuri aistiprosessoinnin herkkyys Internet-sosiaalisuuden suosimisen vai oliko syynä psyykinen huonovointisuus.

Asiasanat: Internet, henkinen hyvinvointi, herkkyys, persoonallisuus, sosiaalinen vuorovaikutus

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# 1 INTRODUCTION

The Internet has fundamentally changed the way we socialize. The use of the Internet is a relatively new phenomenon in the lives of average individuals, but its usage has increased continuously ("Number of Internet Users - Internet Live Stats," 2014). Social use of the Internet has been studied largely from the perspective of potential problems it may cause. (e.g. Anderson, 1998; Chak & Leung, 2004; Kraut et al., 1998; Kubey, Lavin & Barrows, 2001; Yang & Tung, 2007). When the topic arises in the media, the debate often focuses on fears and the alleged negative consequences. Unfortunately, so far the potential benefits of social Internet use have received less attention. (e.g.. McKenna & Bargh, 1998).

Computer-mediated communication is clearly a popular mode of interaction, judging from the popularity of social media and the broad supply of different instant messaging tools, discussion boards and other applications designed for interpersonal interaction. For some individuals, computer-mediated communication can be even a primary channel for social interaction (e.g. Caplan, 2003; Caplan 2005; Munoz, 2013).

Why do some people choose the Internet as a primary medium for interacting with others? Social preference for Internet has been studied before in relation to, for example, shyness, self-esteem, minority status, social skills and personality traits such as introversion (Amichai-Hamburger, 2002; Caplan, 2003; Caplan, 2005; Correa, Hinsley & de Zuniga, 2010; Joinson, 2004; Lee & Stapinski, 2012; McKenna & Bargh, 1998). Clear consensus of why some people prefer to communicate via Internet has not been established. The focus of this thesis was to find out whether an individual feature known as sensory-processing sensitivity (SPS) can help to explain the phenomenon.

In the present study, it is proposed that people who score high on sensory-processing sensitivity - highly sensitive individuals - prefer to socialize via the Internet. The presumption behind this hypothesis is based on an assumption that SPS influences the social life of an individual. Highly sensitive persons

(HSPs) are more sensitive to both external and internal stimuli, often feel uncomfortable in novel situations, process sensory information in greater depth which can manifest as slow processing, and express greater emotional reactivity (Aron & Aron, 1997). Aron and Aron (1997) have proposed that an underlying reason for shyness and social withdrawal might not be a trait of shyness or social withdrawal as such, but at least in some individuals these behavioral patterns might be expressions of SPS. The sensitivity to stimuli is thought to lead to avoidance of certain social situations as a strategy to avoid excessive stimuli (Aron & Aron, 1997). Even if the avoidance of excessive stimuli leads to social withdrawal, it can be assumed that these individuals still have a need to express their personality and themselves in a social environment and thus they will try to find an environment that would enable it (Baumeister & Leary, 1995; McKenna & Bargh, 2002). Based on these presumptions, it is argued that persons who are socially withdrawn due to of SPS might not express this withdrawn behavior online, because social situations in the Internet include less sensory stimuli and the stimuli can be controlled to greater extent than in face-to-face interaction, the tempo of interaction is slower, and the physical environment is more familiar and more predictable. If HSPs are less withdrawn while online, it could be expected that these individuals might have a social preference for online interaction more often than people who score lower on sensory-processing sensitivity.

The goal of the current thesis was to investigate if the social preference for Internet can be explained by SPS and whether this preference can be considered as adaptive and beneficial behavior for those who are highly sensitive. These issues were addressed through several questions concerning behaviors and attributes related to them. The question of whether SPS can explain the social preference for the Internet was operationalized as whether the individuals' levels of SPS and preference for online interaction, when measured in time spent online, correlated. In addition, the amount to which important personal relationships of the HSP's took place online was measured and compared to those of the non-HSPs. It was also measured whether the HSPs and the non-HSPs differed in terms of the channels and types of communication they used while online. The question of whether this possible preference for online interaction was beneficial to the highly sensitive was measured by the psychological wellbeing of the highly sensitive who preferred different communication modalities. The same question was also addressed through the measurement of shyness and sociability in both online and offline environments in both the HSPs and non-HSPs.

There are several motivations to research the subject. As only a minority of the population is highly sensitive (Borries, 2012), it is likely that society and its functions are not optimal for their needs. HSPs are detail-oriented and often highly conscientious (Aron & Aron, 1997). There is a chance that the skills and full potential of HSPs might not be utilized to the fullest, because of suboptimal environments such as open-plan offices that expose employees to high degrees of intense stimuli. Highly sensitive individuals benefit more than less sensitive



persons from optimal circumstances and suffer more in suboptimal environment (Aron & Aron, 1997; Aron, Aron & Davies, 2005) and therefore it would be worthwhile to design work and educational environments that meet the needs of HSPs. This might increase their productivity and also raise their quality of life. Thus the information about the communication preferences of HSPs might be utilized in designing everyday environments that require communication.

A second motivation for the present study was to find out whether social Internet use could be seen in more positive light than it often is. It was hypothesized that online interaction might offer a second, alternative chance for HSPs to fulfill their social needs in a less stressful way, and so at least to this population the social use of Internet could be seen as positive and adaptive behavior.

The data used in the present study was collected with a structured online-survey (N = 362). The survey included scales and questions that measured sensory-processing sensitivity (*Highly Sensitive Person Scale*, Aron & Aron, 1997), shyness and sociability in both online and face-to-face environments (*Shyness and Sociability Scales for Adults*, Asendorpf, 1987 ; Asendorpf & Wilpers, 1998), average hours spent online and offline in social interaction, the extent to which the most preferred relationships of the respondents took place online, and psychological wellbeing (CORE-10, Barkham et al., 2012).

The following sections include a review of previous research concerning the question of which groups seem to have a preference for online interaction (section 2.1). In addition, the quality of relationships that take place in the Internet are discussed to increase understanding of whether the Internet can be considered a beneficial alternative social environment in general (section 2.2). In the section 2.3, the potential consequences of social preference for computer-mediated communication are discussed. The subsequent section (3.1) introduces the concept of sensory-processing sensitivity and its implications in the life of an individual. Due to earlier observations of a link between a social preference for the Internet and introversion and shyness, the associations between introversion and shyness and SPS will be discussed (section 3.2). After this section it will be covered why it is assumed that high levels of SPS might lead to preference for online interaction (section 3.3). The research questions and methods will be outlined in more detail in the subsequent sections (sections 4.1 and 4.2), and the final sections address the findings and their implications (sections 5.1 - 6.4).

## 2 THE INTERNET AS A SOCIAL ENVIRONMENT

From the 1970s to the 1990s the Internet was mainly used in academic circles. General public gained access to it in the 1990s. (Thorne, 2008.) At the end of the year 2005 the number of Internet users worldwide was estimated to be more than a billion (Thorne, 2008). After 2005, the number has risen to nearly three billion users ("Number of Internet Users - Internet Live Stats," 2014).

Despite the fact that the Internet has been used by the general public for a relatively short period of time, it has become a very integral part of everyday life for the majority of Finnish people. In 2013, 85 % of 16–89-year-olds Finns used the Internet. 76 % of 16–24-year-olds used the Internet several times a day. In 25–34-year-olds the proportion was 88 % and in 35–44-year-olds it was 80 %. Only 67 % of 45–54-year-olds used the Internet several times a day. In older age groups the percentages decreased, so that only 6 % of 75–89-year-old Finns used the Internet several times a day. (Suomen virallinen tilasto (SVT), 2014) Thus, young adults are the most active Internet users in Finland, although other age groups seem to be also quite active.

Use of the Internet should not be understood as a one whole that only has one kinds of effects. The Internet can be used for many purposes, for example, social, leisure-related, and information-seeking purposes. (Hamburger & Ben-Artzi, 2000). Therefore it can be seen as a medium for the implementation of various functions, in which case findings related to certain kind of Internet use cannot be generalized to apply to all Internet use. In this thesis the focus is on social use of the Internet.

In a number of studies on the use of the Internet, the Internet is compared with "real world" (e.g. Amichai-Hamburger, Wainpel, & Fox, 2002; Valkenburg, Schouten & Peter, 2005). Activities carried out in the Internet and online-relationships are seen as somehow "non-real", which contains perhaps an implication of these things being less genuine or less valued than activities and relationships which take place in the "real world". To avoid such preconceptions, in this paper the terms "offline" or "face-to-face" will be used instead of "real world". As online activities merge more and more into

everyday life, one environment cannot be thought as more “real” than another. It has been reported that for some individuals it is easier to show their “real self” on the Internet rather than in face-to-face interaction (Amichai-Hamburger et al., 2002). Hence, for some people the Internet could even be considered to be more “real” of the two worlds.

The impact of sensory-processing sensitivity to the social use of the Internet has not been previously studied. Links between other individual characteristics and social preference for Internet will be discussed in the following sections, as well as the possibilities of the Internet to be a fulfilling social medium and whether the social use of the Internet might have any long-term consequences for individual users.

## **2.1 Individual characteristics and social preference for the Internet**

Some people use the Internet for social purposes more than others, and this behavioral difference may be attributed to many factors. Links between several individual characteristics and social preference for the Internet will be discussed in this section. Increased Internet use in respect of time and pathological, addictive use of Internet are not distinguished in the text at all times, as the difference was not evident in all the studies.

Several factors have been observed to influence Internet use habits. Social preference for online interaction can develop because of, among other things, if the person perceives face-to-face interaction to be unsatisfactory because of a feeling of not being valued by others, or because of a lack of social contacts outside of the Internet (Papacharissi & Rubin, 2000). Other factors that have been observed to have an association with increased preference for online socialization include certain personality traits (e.g. Amichai-Hamburger, 2002; Correa et al., 2010), psychological distress (e.g. Caplan, 2003; Correa et al., 2010; Lee & Stapinski, 2012), low self-esteem (Joinson, 2004), belonging to a minority that is discriminated against (McKenna & Bargh, 1998) and having poor social skills (Caplan, 2005).

An example of the effect of personality traits on Internet use is the effect of individual differences in the trait of extraversion-introversion. Extraversion is generally associated with high sociability, risk-taking and impulsivity, while the introverts are thought as quiet and reflective individuals who do not long for excitement (Eysenck & Eysenck, 1975). Introversion-extraversion has often been observed to have an effect on individual’s Internet use habits, but the observations have been inconsistent (Gross, Juvonen & Gable, 2002; Kraut et al., 2002). Some researchers have argued that the Internet is mainly used for social purposes by extroverted individuals, who use it to acquire more contacts to

their initially extensive social networks (Kraut et al., 2002). On the other hand it has been suggested that the users are mainly introverts who suffer of social anxiety and who therefore have difficulties in forming social relationships offline (McKenna & Bargh, 2000). One possible explanation for the inconsistent findings might be differences in the ages of the subjects used in different studies, as younger generations might use the Internet in different ways than older individuals.

It has been observed in other studies that introverts and individuals with high level of neuroticism use the Internet more than extraverts and non-neurotic individuals (Amichai-Hamburger, 2002; Hamburger & Ben-Artzi, 2000). In this context, neuroticism refers to the tendency to feel negative affect when one encounters even minor stressors (Eysenck & Eysenck, 1975) - this feature resembles higher than average emotionality of the highly sensitive persons (Aron & Aron, 1997). In one study concerning study environments, introverts preferred online-lessons whereas extraverts preferred face-to-face lessons - other personality traits were not linked with variation in this preference (Harrington & Loffredo, 2010). The results of introverts preferring the Internet as a social environment have not been able to be reproduced in all studies. In one study, young people who had a social preference for the Internet did not differ from others in regards to the trait of introversion-extraversion (Munoz, 2013). In this case, too, one possible explanation is that the subjects of Munoz (2013) were young and therefore their Internet use habits might have differed from the population as whole.

Conflicting results have also been obtained in respect of shyness. On the other hand shyness have been associated with higher Internet use (Chak & Leung, 2004; Yang & Tung, 2007), but at the same time, this kind of link have not been found in several studies (Henderson, Zimbardo & Graham, 2002; Mandell & Muncer, 2006; Scealy, Phillips & Stevenson, 2002).

Psychological distress, such as depression and loneliness, has been observed to predispose individuals to excessive and compulsive Internet use. In one study, it was found that loneliness and depression explained 19 % of the preference for online social interaction (Caplan, 2003). Social anxiety is also a strong predictor of problematic Internet use (Lee & Stapinski, 2012). Social situations online lack several situational factors that might cause anxiety offline. Such factors include the social pressure to answer without delay when having a conversation, and seeing the communication partner face-to-face, which are the main reasons why it is assumed that people suffering from social anxiety might turn to the Internet more readily than the average population when trying to find social connection (McKenna & Bargh, 1999a). These reasons are similar to those why it is assumed that HSPs might prefer online social interaction and there has been an observation of SPS and social anxiety being associated (Liss, Mailloux & Erchull, 2008). It has been argued that psychologically distressed individuals have a social preference for the Internet because online environment enables anonymity, greater control over self-presentation, higher and more intimate self-disclosure, lower perceived social risk and less social

responsibility towards others (Morahan-Martin & Schumacher, 2000; Walther, 1996).

Self-esteem is also found to be associated with a preference for computer-mediated communication. In one experimental study, it was found that individuals with lower self-esteem chose to use e-mail in an imaginary situation involving social interaction, whereas individuals with higher self-esteem rather chose face-to-face communication. Both groups chose e-mail when the social situation was manipulated in a way that the participant had to imagine a greater possibility of being rejected by their communication partner. (Joinson, 2004.) Thus, people tend to choose a communication channel that does not involve face-to-face communication in situations when a negative reaction is anticipated (O'Sullivan, 2000).

It has been speculated that as the online services and Internet usage patterns change, it also has an impact on the population of Internet users. As social Internet services are becoming less anonymous and the popularity of social media is rising, it has been argued that nowadays the Internet will attract more extraverts than before. This might explain the discrepancies found in studies on introversion and Internet use. Extraverts have been observed to use more social media and instant messaging services when compared with introverts, which supports the view of changing user population. (Correa et al., 2010.) Also individuals who score high on neuroticism use instant messaging services more than people low on neuroticism, which have been attributed to a possibility to consider ones replies longer than in face-to-face conversation (Ehrenberg, Juckes, White & Walsh, 2008).

## **2.2 The quality of relationships on the Internet**

Among other goals, the Internet is used for social purposes. As early as 1996 it was reported that over 60 % of newsgroup users formed personal relationships with other users (Parks & Floyd, 1996). Today, social media and other social Internet services are part of everyday lives of a growing number of people.

Social behavior has been observed to be qualitatively different in the Internet compared to face-to-face communication. Some researchers have described computer-mediated communication to be the most socially distancing and impersonal mode of communication (Mathezon & Zanna, 1998), but many studies suggest that the truth seems to be quite opposite. When communicating online, individuals disclose more, the disclosed information is more personal and it can be less socially desirable (Joinson, 2004). The phenomenon has been observed in studies concerning online-counselling (Barak, 1999; Barak & Fisher, 2003), social support groups (Preece, 1999), online communities (Rheingold, 1993), web-based story boards (Rosson, 1999) and in web-studies of social desirability (Joinson, 1999).

It has been suggested that the self-disclosure that computer-mediated communication promotes might lead to higher relationship quality, which in turn would contribute to wellbeing of individuals (Valkenburg & Peter, 2009). This assumption is supported by empirical findings, as self-disclosure has been observed to be a significant factor in relationship formation and quality (McKenna & Bargh, 2000; McNelles & Connolly, 1999), and relationship quality has been linked with individual's wellbeing (e.g. Erdley, Nangle, Newman & Carpenter, 2001).

This heightened self-disclosure is sometimes called hyperpersonal interaction (Walther, 1996). The phenomenon is thought to be the result of anonymity and lesser non-verbal and demographic cues (Caplan & Turner, 2007; Wright, 2002). Other possible contributing factors are asynchronous interaction (Walther, 1996) and uncertainty reduction (Tidwell & Walther, 2002) that occur in online communication. These factors are thought to affect individual's self-awareness and self-presentation concerns and consequently lead to hyperpersonal interaction (Joinson, 2004).

For some groups of people Internet use has clear social benefits. It has been observed, for example, that shy people feel less communication apprehension while interacting on Second Life, which is a virtual 3D service, when compared with face-to-face interaction (Hammick & Lee, 2013). Shy people also seem to benefit from online dating services (Scharlott & Christ, 1995). There is growing evidence that shy individuals benefit from computer-mediated communication as it facilitates easier communication and reduces the effect of shyness and therefore provides an opportunity to increase the number of social contacts (Birnie & Horvath, 2002; Scealy et al., 2002). It is not surprising that it has been observed that the shy and non-shy individuals do not differ from another in regards of four aspects of shyness while online. These are rejection sensitivity, initiating relationships, self-disclosure, and providing support and advice. (Stritzke, Nguyen & Durkin, 2004.)

Forming social relationships online also seems to be beneficial for introverts and for individuals who score high on neuroticism. Amichai-Hamburger et al. (2002) found that introverts and individuals who scored high on neuroticism were more likely to perceive their "true self" to be located online, while the extroverts and non-neurotic individuals perceived their "real selves" to be located in the world outside the Internet. The concept of "real self" referred in this study as to how open the participants were of themselves in these two environments. It is essential for individual's wellbeing to be able to express their true self in a social context (Rogers, 1951), and therefore the opportunity to form relationships online is likely to be relevant to the wellbeing to the groups mentioned above.

A number of studies have confirmed that it is possible to form satisfactory, long-lasting and healthy relationships via the Internet (Bargh et al., 2002; Cornwell & Lundgren, 2001; McKenna, Green & Gleason, 2002). However, it should be noted that when the quality of romantic relationships was compared between online-relationships and relationships that take place face-

to-face, the online-relationships, on average, were taken less seriously and the participants were less committed to them (Cornwell & Lundgren, 2001). When another study examined all relationships important to the participants – not only romantic – no difference was found between the quality of online and offline relationships (Lee & Stapinski, 2012).

Social relationships formed originally in the Internet will not always stay online. Online-relationships can, and often do transfer into face-to-face relationships (McKenna & Bargh, 1999), which might be advantageous to those individuals who have difficulties in establishing social relationships offline. So the Internet is not necessarily only a substitute for face-to-face interaction, but it might actually function as a gateway through which relationships, that might be easier to form online for some individuals, proceed to become face-to-face relationships.

### **2.3 Long-term effects of social Internet use**

As stated in the previous sections, several individual factors seem to have an association with social preference for the Internet. For some groups, such as shy persons, the use of the Internet for social purposes would seem to be adaptive and beneficial behavior (Hammick & Lee, 2013; Scharlott & Christ, 1995). It has also been noted that it is possible to form viable, fulfilling relationships via the Internet and that the features of hyperpersonal interaction even contribute to it. Before drawing a conclusion of the Internet being purely beneficial for interpersonal relationships, the findings regarding associations between depression, anxiety, shyness, and social preference for the Internet must be considered. It should be noted that it is not clear whether there is a causation, and to which direction. What kind of long-term effects might be associated with the social preference for the Internet?

It is essential to consider possible adverse effects of social Internet use as in the present study it is proposed that it might be a viable channel for HSPs to pursue their social needs. It is especially important, as it is assumed that the HSPs use the Internet because of social reasons and it has been found that people who use the Internet for social purposes spend more time online (Young, 1996). Those who spend more time online in turn reported more negative consequences related to Internet use than those who were less online (Anderson, 1998).

Use of the Internet is often thought to lead to depression and social isolation. This view has emerged both in media and among psychologists. However, the effects of Internet use on wellbeing seem to be ambiguous and dependent of context and the characteristics of the individual. (McKenna & Bargh, 2000.)

Especially in the earlier studies on Internet use in the late '90s and in early 2000s it was argued that the more time a person used online, the less time they had for social life outside of the Internet, and as a consequence, the number of their offline-relationships declined and this led to reduced psychological wellbeing (e.g. Kraut et al., 1998). However, these findings should not be generalized to present day online interaction. Before, because Internet connections at home were rare, it was unlikely that individual's relationships offline would extend to the Internet (Valkenburg & Peter, 2009). In comparison, nowadays almost everyone, at least in younger generations, use the Internet (Lenhart & Madden, 2007; Suomen virallinen tilasto (SVT), 2014). It has been suggested that the consequences of social Internet use might be less negative, when the online interactions happen with friends who the user is already familiar with, rather than with strangers (Valkenburg & Peter, 2009).

The use of the Internet for social purposes does not automatically protect the individual from adverse effects. It is alarming, that in fact, the use of the Internet especially for communication predisposes the user to compulsive Internet use. However, this effect was limited only to the use of synchronized communication services such as instant messaging or IRC and not to the non-synchronous ones, such as e-mail (van den Eijnden, Meerkerk, Vermulst, Spijkerman & Engels, 2008). The use of synchronous communication services has been associated strongly with academic impairment (Kubey et al., 2001). However, all social interaction online does not seem to lead to deteriorated academic performance (Munoz, 2013).

So, can substantial Internet use for social purposes have adverse effects on an individual's wellbeing? It has been argued that psychological distress can predispose individual to excessive and compulsive Internet use and that these problematic habits play a part in maintaining and exacerbating the original psychological issues. This is thought to be a result from the fact that depressed and isolated individuals perceive their social competence to be lower than average, and consequently develop a preference for online interaction as it feels less threatening than face-to-face interaction. This in turn can lead to excessive and compulsive Internet use, which can worsen the already existing problems and might lead to new ones. (Caplan, 2003.)

Caplan (2003) found that the preference for computer-mediated communication explained 21 % of compulsive Internet use and 17 % of the negative consequences attributed to problematic Internet use. This can be interpreted to mean that a preference for online interaction is not the only factor affecting the adverse consequences – most of it must be explained by other means. However, it remains unclear how likely it is that preference for online interaction leads to the development of problematic Internet use.

Internet usage of shy individuals have been studied to determine whether it is a resource that is useful in that it enhances the feeling of social competence and helps to build interpersonal relationships, or is it a risk factor that isolates shy individuals even further. (Saunders & Chester, 2008). In this thesis, a similar question regarding HSPs is stated – is the assumed preference for online



interaction a positive resource or a risk factor? At least shyness seems to predispose individual to the development of Internet addiction (Chak & Leung, 2004; Yang & Tung, 2007).

It is essential to understand whether the Internet use itself might lead to shyness or if it is shyness indeed which leads to increased Internet use. Russell, Flom, Gardner, Curtona, and Hessling (2004) state that both options are possible: On the other hand the time spent on the Internet is time that is not spent in face-to-face interaction, and this might lead to social isolation and shyness. On the other hand shy individuals might choose the Internet as their primary social channel, because they find it hard to form social relationships outside of Internet.

It has been suggested that the effects of Internet use might depend on the personality or other characteristics of the individual. This idea is supported by the findings from different studies that are highly ambiguous in relation to the effects of Internet use on the wellbeing of the users. For example, some studies have shown that Internet use increases social support, the number of social relationships, and wellbeing (Kraut et al. 2002; Silverman, 1999), whereas other researchers have found an opposite effect (Kiesler & Kraut, 1999). In one study any association between these two variables was not found, although there were indications that those individuals who used the Internet for social purposes reported higher experience of social support (Swickert, Hittner, Harris & Herring, 2002). The increased social connectedness and wellbeing are mostly observed in such cases where the Internet is used to maintain existing relationships instead of communicating with strangers (Bessièrè, Kiesler, Kraut & Boneva, 2008).

In conclusion, the effects of Internet use habits to the individual's wellbeing are not unequivocal. It is possible that some groups benefit from the social use of the Internet and it seems that individual characteristics affect the way individuals use the Internet. In the next section the concept of SPS will be discussed among how it might affect the Internet use habits and their effect on the wellbeing of the highly sensitive.

### **3 SENSORY-PROCESSING SENSITIVITY**

The present study has been conducted on the basis of the assumption that sensory-processing sensitivity might be one factor to explain the social preference for online interaction. The concept of SPS will be discussed in this section, along with how it manifests itself in the life of highly sensitive individuals and why it may affect which forms of communication individual prefers. In addition, the link between SPS, and shyness and introversion will be addressed, as these two traits have previously been associated with preference for online interaction - even though the findings have been somewhat ambiguous.

#### **3.1 The concept of sensory-processing sensitivity**

A number of animal species, from fish to primates, have been observed to exhibit differences between individuals in their sensitivity to react to their environment (e.g. Hessing, Hagelso, Schouten, Wiepkema & Vanbeek, 1994; Higley & Suomi, 1989; Lyons, Price & Moberg, 1988; Verbeek, Drent & Wiepkema, 1994; Wilson, Coleman, Clark & Biederman, 1993). An individual animal can utilize one of two different strategies, which are the strategy of higher reactivity and that of lower reactivity (Aron, Aron & Jagiellowicz, 2012). The majority of any population generally uses the strategy of lower reactivity, which manifests as taking of higher risks. In contrast, the strategy of higher reactivity utilized by the minority manifests as more precise and reserved selection of activities. (Wilson, 1993.) It has been even suggested that this difference in reactivity might be a fundamental difference behind the formation of personalities of animals (Wolf, Van Doorn & Weissing, 2008).

These two strategies seem to be utilized also by humans. Sensory-processing sensitivity is a concept formed by Aron and Aron (1997) to represent

the strategy of higher reactivity in humans. Based on interviews of sensitive persons and later quantitative studies, Aron and Aron (1997) developed a scale for measuring SPS (*Highly Sensitive Person Scale, HSPS*). This scale was used in the data collection for this paper (Appendix 1, item 8).

It appears so that SPS is not a normally distributed feature in the population, but rather a qualitative variable with two categories. In one study of more than 900 participants, it was found that 17.5 % of the sample were in the category of the highly sensitive (Borries, 2012). Borries (2012) argues that individuals either are highly sensitive or not.

Aron (2012) summarized SPS to be composed of four factors. These are 1) depth of processing, 2) susceptibility to overarousal, 3) high emotionality and 4) sensitivity to subtle stimuli. However, the effects of SPS on an individual's life are not simple and depend on the environment. Highly sensitive individuals are more susceptible to environmental influences than those who are less sensitive and it has been found that, for example, childhood conditions have a greater impact on the wellbeing of sensitive individuals. This effect has been found to apply to both unfavorable and favorable environments, so that sensitive individuals benefit more from a favorable environment and show more adverse symptoms in a negative environment. Aron and Aron (1997) found that those HSPs who felt that their childhood environment was good, had better academic and occupational performance and they also perceived their sensitivity to be more positive trait. In contrast, psychiatric disorders were highly common among those who had a history of adverse childhood environment and these individuals felt that their sensitivity made them vulnerable, handicapped or defective (Aron & Aron, 1997). The same phenomenon has also been observed in college-students, among whom those who scored highest on the HSPS reacted more strongly to both positive and negative feedback (Aron et al., 2005).

SPS is assumed to be an inherent quality of temperament that causes higher reflectivity, sensitivity to subtle stimuli, and discomfort when encountering novel situations (Aron & Aron, 1997). This sensitivity applies to both internal stimuli, such as pain or hunger, and external stimuli, such as light or sound. Because sensitive individuals are more sensitive to subtle stimuli, they are more likely to encounter novel stimuli, and therefore are more likely than less sensitive individuals to encounter new, uncomfortable situations in the same environment (Aron, 2000). Because of these features, the highly sensitive might give an impression of cautiousness, inhibition or shyness (Aron & Aron, 1997). The fact that the highly sensitive are more susceptible to the impact of negative events may in fact result in them becoming actually more shy or apprehensive (Aron, 2000). However, Aron (2000) does not consider negative affect, shyness or apprehension to be illustrative concepts for the trait of general sensitivity, because the manifestations of sensitivity differ depending on the environment.

SPS can have both positive and negative effects on the sensitive individual's life. It can manifest as such positive attributes as conscientiousness,

creativity, empathy and increased ability to interpret non-verbal cues. On the other hand it can manifest as a difficulty in speaking in groups or with strangers, especially in highly arousing surroundings such as in school or at parties. (Aron, 2004.) A highly sensitive individual usually needs more time than an average person when in a novel or ambiguous situation, so that they can observe the stimuli thoroughly and compare them with previously encountered experiences. This might give the impression of shyness or inhibitedness. On the other hand, when in a familiar situation, the sensitive person does not seem as inhibited, because the situation is already processed extensively. (Aron et al., 2012.) This deep information processing is driven by negative and positive emotions which are stronger than on average (Aron & Aron, 1997). Even though the higher emotional reactivity is considered to be a part of the concept of SPS, Aron et al., (2012) suggest that it might be manifested more obviously mainly in the most sensitive individuals.

### **3.2 SPS's relation to introversion and shyness**

Even before Aron and Aron (1997) proposed the concept of sensory-processing sensitivity, other researchers have studied several phenomena which are in many aspects very similar to SPS. These include introversion (Eysenck, 1981; McRae & John, 1993), inherent shyness that is associated with inhibition (Kagan, 1994), timidity (Wilson et al., 1993) and reactivity (Suomi, 1991). Thomas ja Chess (1977) regarded low sensory threshold as one of nine temperament traits in respect of which children differ from another. Sensitivity to sensory stimulus has been studied in the context of personality traits also in fairly recent years. For example, when studying temperamental differences, Rothbart and Bates (2006) mentioned differences in children's ability to detect subtle stimuli and in how uncomfortable they perceived strong stimulus to be.

Of particular interest to the present study is the link between SPS and introversion, as it seems that introversion might be associated with the preference for online social interaction. The concept of introversion has undergone changes during different times. Often, it has been conceptualized and measured in the degree of sociability (e.g. Humphreys & Revelle 1984). On the other hand, Jung (1971) approached introversion as a feature that resembled the present concept of SPS quite a lot. He perceived introversion as a tendency to approach novel situations in such way, that the situation could be comprehended thoroughly through subjective processing. In addition, Eysenck (1957) argued introverted behavior to be a manifestation of the fact that introverted individuals are slower than extraverts to show habituation to repeated stimulus, which, again, resembles phenomena observed in HSPs. Because of the slow habituation, introverts attempt to protect themselves from excessive stimuli to avoid overarousal, whereas extraverts whose habituation is faster, seek novel stimuli to avoid boredom (Eysenck, 1981). Especially the older

descriptions of introversion that have less emphasis on sociability have similarities with SPS.

According to Aron (2000), there has been findings that suggest that individual differences in sensitivity might be the factor that explains introversion and extraversion at least in some cases. For example, introverts have been found to be more able to detect low sound frequencies (Stelmack & Campbell, 1974), to be more sensitive to pain (Barnes, 1975), and to have lower electrocutaneous (Edman, Schalling & Rissler, 1979), olfactory (Herbener, Kagan & Cohen, 1989), and visual thresholds (Siddle, Morrish, White & Mangan, 1969). This sensitivity is not due to more sensitive sensory organs, but it is rather a result of processing that takes place in the brain (Aron & Aron, 1997).

The association between introversion and SPS is also supported by a finding that suggest that introverts seem to have a greater tendency to be reflective in terms of learning and problem solving. Introverts are more inclined to use more time to reflect after making a mistake, whereas extraverts prefer to try again immediately. (Patterson & Newman, 1993.) Introverts have also been found to be more vigilant during discrimination tasks (Koelega 1992), to be more prone to implicit learning (Deo & Singh, 1973) and to be slower to both acquire and forget information as a result of the depth of processing (Howarth & Eysenck, 1968). The higher sensitivity of introverts is, therefore, evident in many ways, and although introversion has been studied mostly as a trait that represents low sociability, it seems to have an association also with sensitivity to various stimuli, and deeper cognitive processing.

In addition to introversion, also inhibition and shyness have been found to have an association with sensitivity. Sociologist Gilmartin (1987) studied shy men who had difficulties in forming romantic relationships, and found the subjects having a higher than average tendency to startle, significantly increased sensitivity to extreme temperatures, loud noise, pain, rough clothes, bright sunlight, and small distractive stimuli such as sand in a shoe, and they also reported higher reactivity to seasonal fluctuations of light. They also had more allergies and skin irritation, which also has been observed in inhibited children (Bell, 1992). These qualities are similar to those that HSPs have reported (Aron & Aron, 1997).

Although introversion has been regularly found to be linked with a sensitivity for processing sensory information, it is not completely overlapping concept with SPS . Aron and Aron (2007) measured correlations between introversion and SPS and found that they ranged from .14 to .45, depending on the measure of introversion. The largest correlations were found when the measure for introversion was that of Eysenck's and Eysenck's (1975). In addition to items measuring sociability, this measure included items measuring arousability and impulsivity, in other words, items that measured pleasure that was experienced in situations that involve high stimulation. (Aron & Aron, 2007.)

So, how can it be explained that introversion is so often found to be linked with sensitivity of sensory processing, but the statistical correlations between introversion and SPS are not very high? Clearly, SPS cannot fully explain the placement of an individual on the introversion-extraversion axis. Aron (2004) argues that the findings suggesting sensitive qualities in introverts are the result of sensitivity and low sociability being partly overlapping qualities. It is possible that individuals whose sensory processing is highly sensitive avoid highly arousing situations, such as crowds and novel social situations to avoid overarousal and this manifests as introverted behavior. It would be the sensitivity of these individuals that is detected in the studies on introversion. Another reason for the relatively small correlations is that there are introverts who are not highly sensitive in regards to sensory processing. The reason for their avoidance of social situations is not because of overarousal but rather because of, for example, avoidant attachment style (Bowlby 1969; Cassidy & Shaver 1999) or other negative social experiences. (Aron, 2004.)

Therefore, for some individuals, SPS can lead to social withdrawal, but this is not the case for all HSPs. A small portion of HSPs are, in fact, extraverts, but these individuals have reported higher than average need for solitude and quiet, unlike other extraverts (Aron & Aron, 1997). Regardless, it can be assumed that the link between introversion or shyness, and social preference for the Internet might predict similar link in regards of SPS, as these traits are somewhat overlapping. This overlapping with sensitivity might even explain at least partially why online social interaction is more comfortable for some shy and introverted individuals, although this assumption is entirely hypothetical at this point.

### **3.3 SPS and the social preference for online interaction**

In the current thesis, a hypothesis is presented according to which SPS might lead to a social preference for online interaction. This is presumed to be due to both SPS and its manifestations that hinder face-to-face social interaction, and to the features of computer-mediated communication that address these difficulties and therefore cause the Internet to be more attractive medium for social interaction.

Appropriate level of arousal is important for the highly sensitive and exposure to excessive stimuli can lead to overarousal, which in turn, among other things, reduces cognitive performance (Aron et al., 2012). Thus, it is possible that for their own convenience, a sensitive individual avoids overly stimulating situations. The need for appropriate levels of arousal also implies that it would be important for HSPs to have an opportunity for study and work environments in which they could avoid excessive stimuli.

Many environmental stimuli are of social quality, which is why SPS can lead to social withdrawal as a strategy to avoid excessive stimulation and the overarousal it causes. Shyness often occurs in social situations that include group interaction and meeting strangers. These intense and complex situations are characterized by unpredictability and novel elements. Especially novel social situations and large groups of people can be exhausting for HSPs. (Aron, 2000.)

It has been speculated that some HSPs adopt a strategy of avoiding social situations voluntarily and, in fact, are not actually fearful of them or experience feelings of inferiority for avoiding them. At the same time, it is plausible that some portion of the HSPs do not use this strategy, but rather try to act similarly to those who are not highly sensitive, and this results in them feeling highly uncomfortable in situations that include excessive stimulation. In some cases, avoidance of social situations is argued to lead to development of shyness, as by avoiding social situations the individual has fewer opportunities to practice their social skills. In addition, overarousal hinders overall performance and this affects also performance in social situations. Because of these two factors, the highly sensitive individual may perform poorly when in a social situation. When in a similar situation in the future, in addition to the baseline poor performance, the individual also has a recollection of their previous failure, and this, in turn, hinders their performance even more. This can escalate into a cycle of avoiding social situations and thus the individual becoming even shyer. (Aron, 2000.) Therefore, some social situations can be challenging to HSPs both because of the overarousal the situation causes and because of the shyness previous exposure have caused indirectly.

Generally, people have a need to find social environments which allow them to express their personalities. If this is not possible in their immediate environment, the individual is generally inclined to seek an alternative environment to fulfill this need (McKenna & Bargh, 2002). There are three main reasons to why the Internet is presumed to be more pleasant medium for social interaction for HSPs: 1) The intensity of stimuli is lower and the individual has more control over it, 2) the tempo of the interaction is slower, and 3) the physical environment is more likely to be familiar.

Face-to-face social interaction often occurs in circumstances where there is background noise and several things are happening simultaneously. In contrast, the Internet is most often used at home, where the sensory load is generally significantly lower. At home, individual also has greater degree of control over different stimuli, such as sounds and lights.

In addition to physical stimuli, control of social stimuli is likely to be easier online than in face-to-face situations. One can easily take a break from a situation, for example, by leaving the computer for a while. As noted before, it has been found that when in a social situation in which there is a high likelihood of negative reaction from the communication partner, usually computer-mediated communication is preferred over face-to-face interaction (O'Sullivan, 2000). Since HSPs have a higher tendency to experience negative

affect (Aron & Aron, 1997), it is possible that this tendency might be even more pronounced in them.

Because HSPs are easily affected by other individuals' mood, both positive and negative moods by others can raise the arousal level of HSPs to uncomfortable levels. HSPs often need significant amounts of solitary time, perhaps to recover from wearing situations. (Aron & Aron, 1997.) Because society often requires participation in activities that involve social interaction, for example in work and in educational surroundings, it is presumed that a sensitive individual might prefer to spend their free time more likely in solitary, quiet surroundings. Computer-mediated communication takes place via fewer sensory channels than face-to-face communication as it does not include many non-verbal cues, such as body gestures, facial expressions, tone of voice, or touch. This might reduce the strain of social situations and therefore make the Internet a communication channel that can be utilized even when recovering from the mandatory face-to-face social interactions.

In addition to the intensity of stimuli, the tempo of communication is presumed to have an effect on the level of arousal of HSPs. The pace of discussion in face-to-face communication and especially in group situations is often fast and the discussed subjects change rapidly. This might frustrate the highly sensitive individual who needs more time to process information and have a tendency to discuss topics in detailed fashion (Aron & Aron, 1997).

Although there are group discussions in which several participants speak simultaneously in the Internet as well, the textual nature of communication allows participants to differentiate separate statements from another easier than it is the case in spoken conversation. Textual modality also enables the participant to return to previous statements when needed, and to edit their own text before sending it. This is possible in synchronous applications, such as chat rooms, but even more so in asynchronous channels, such as discussion boards. Discussion boards also allow the user to form longer responses, which enables them to go into the subject in depth when wanted. The response time is also as long as the user wishes.

One additional quality of computer-mediated communication that might ease HSPs' social activities is the control over the familiarity of the environment. HSPs are often inhibited only in novel or ambiguous situations (Aron et al., 2012). When a social interaction happens over the Internet, the physical and social environment are more easily controlled than in face-to-face interactions. Online interaction can happen in a familiar environment at home, and it is easier to choose who to interact with and when. Interaction in familiar surroundings certainly can also occur in face-to-face interaction, but it is limited to close relationships and limited surroundings. On the contrary, the Internet enables meeting new people in familiar settings, which is less straining than, for example, attending parties or hobbies.

There is no reason to assume HSPs to be less interested in social activities or other people, or that they would need less social interaction than the less sensitive. As noted earlier, some of the HSPs are, in fact, extraverts (Aron &



Aron, 1997). Computer-mediated communication can be thought of as to release the sensitive individual of the restrictions caused by their sensitivity. On the Internet, there are no such limitations to the frequency or duration for social interactions that there is offline, due to excessive stimuli. Of course, the Internet cannot be thought of as being completely free of overstimulating factors at all times. Social situations can sometimes be very intensive online as well as offline.

Previous studies concerning factors that lead to the social preference for online interaction suggest that SPS might also have this effect. There is evidence that introverts and individuals who score high on neuroticism prefer online interaction (Amichai-Hamburger, 2002; Hamburger & Ben-Artzi, 2000). As noted earlier, there seems to be an association between introversion and SPS, although its nature is somewhat ambiguous. A correlation between SPS and neuroticism has been found as well (Aron & Aron, 1997). Other studies show findings of an association between shyness and preference for online interaction (Chak & Leung, 2004; Yang & Tung, 2007), and SPS, in turn, might cause shyness (Aron, 2000). However, it must be kept in mind that the previous studies have not directly addressed SPS, although the findings suggest that certain types of features may be relevant in the formation of social preference for the Internet.

In conclusion, it is possible that HSPs prefer to fulfill their social needs online rather than in face-to-face interaction, as the qualities of high SPS may make face-to-face interaction more strenuous, and as the earlier studies suggest that traits that correlate with SPS likely contribute to the development of social preference for the Internet. In the following sections it will be examined whether SPS actually leads to higher preference for online interaction, and what kind of effects it may have on the wellbeing of HSPs. First, the research problems and the methods will be discussed.

## 4 METHOD

In previous sections, it has been explained what kind of associations there is predicted to be between SPS and the preference for online interaction. This section deals with what kind of research questions were presented and why, and what methods were used to address these questions.

### 4.1 Research questions

The primary goal of this thesis was to determine whether SPS could explain why some individuals prefer to use the Internet for social purposes rather than more traditional forms of interaction. In addition, another goal was to find out whether this alleged preference for the Internet could be considered as adaptive and beneficial behavior for HSPs. Thus, there were two main questions to which answers were sought. These issues were addressed with several sub-questions which will be discussed next.

#### 1) Can SPS explain the social preference for online interaction?

The question of whether SPS can explain the social preference for online interaction was approached from three directions.

- a. First sub-question was **whether there was a link between SPS and the preference for computer mediated communication**, when the preference was measured in free time the HSPs spent online or in face-to-face interaction when compared to those who were not highly sensitive (non-HSPs).

- b. It is possible that the phenomenon might not manifest as a temporal preference, and therefore the second sub-question was **whether the important interpersonal relationships of the HSPs took place in the Internet more often than those of the non-HSPs**. This was thought to reflect the extent to which the Internet could be considered an alternative social medium for the HSPs and whether they rather chose online interaction when communicating voluntarily with important persons in their lives.
- c. The third sub-question was **whether the HSPs and the non-HSPs differed in terms of the channels and types of communication they used while online**. This was thought to solve the question of whether it might be just the avoidance of excessive sensory load that leads to the preference and not something else. It was assumed that the HSPs would prefer to use the types of communication that would enable slower pace, and would produce less sensory stimuli.

## 2) Is the social preference for online interaction beneficial for the HSPs?

There were again three sub-questions to address the main question of whether the social preference for online interaction could be considered adaptive and beneficial for the HSPs.

- a. First of all, it was asked **whether those HSPs who had the social preference for online interaction were better off in regards to mental wellbeing** than those who preferred face-to-face interaction, or those who were sociable neither in the Internet nor in face-to-face situations.
- b. Secondly, it was examined **what kinds of associations there were concerning computer-mediated communication and shyness, in both HSPs and non-HSPs**.
- c. The third addressed matter concerned **the relationship between computer-mediated communication and sociability in HSPs and non-HSPs**.

Shyness is considered to be more related to discomfort in social situations, whereas sociability has more to do with what kind of social situations individual chooses to be in (Asendorpf & Wilpers, 1998). The assumption was that HSPs would benefit in terms of mental wellbeing if they preferred online interaction and that they would feel less shy and more sociable while using the Internet.

## 4.2 Data collection and methods

The data used in the present study was collected with a web-based survey (Appendix 1). The respondents were recruited through social media and a mailing list for the students of the University of Jyväskylä. The survey was conducted in Finnish. The survey measured sensory-processing sensitivity, the average time used in social behaviors daily on the Internet and in face-to-face situations, the extent to which the respondents' important relationships took place in the Internet or face-to-face, shyness and sociability in both online and face-to-face environments, psychological wellbeing, and the preferred communication channels while on the Internet.

SPS was assessed with the Highly Sensitive Person Scale (HSPS) developed by Aron and Aron (1997). The scale consist of 27 statements (Appendix 1, item 8). HSPS is considered to be reliable and valid measure of the concept of SPS (Smolewska, McCabe & Woody, 2006). The effect of social desirability have been minimized by forming the statements in such way that they represent both positive and negative qualities of SPS. Aron and Aron (1997) state that their studies support the scale having high discriminant, convergent, and construct validity.

The shyness and sociability of the respondents in face-to-face interaction situations were measured with the Shyness and Sociability Scales for Adults (Asendorpf, 1987 ; Asendorpf & Wilpers, 1998) (Appendix 1, item 7). It included five-item sociability scale and a five-item scale for measuring shyness. While taking this item of the survey, the respondents were asked to think about only situations that have taken place outside the Internet, that is, face-to-face. Respondents' shyness and sociability in the Internet was measured with the same scales, but they were asked to answer the questions while thinking about situations that have taken place in the Internet. Some of the questions were reformulated to fit better to the online environment (Appendix 1, item 6).

Because the questions concerning shyness and sociability in the Internet were modified from the original scale, their internal consistency was verified with Cronbach's alpha coefficient. The questions concerning shyness had a high alpha value ( $\alpha = .81$ ), whereas the alpha value of the sociability scale was of acceptable level ( $\alpha = .63$ ) (George & Mallery, 2003). Measured from this sample, the original scales had alpha values of .91 (shyness) and .83 (sociability). Thus, the internal consistency of the scales declined slightly when the questions were modified.

The social behavior of the respondents was measured by asking them how many hours they spend in social interaction on an average day in their free time, both online and in face-to-face situations (Appendix 1, items 3 and 4). The time spent in the Internet has been found to be linked with a social preference for online interaction (Casale, Tella & Fioravanti, 2013). The respondents were also asked to which extent their most preferred relationships take place in the Internet (Appendix 1, item 5).

The respondents' psychological wellbeing was measured with a ten-item questionnaire, CORE-10, that measures the most common manifestations of mental distress (Appendix 1, item 9) The scale has been found to have valid psychometric qualities. (Barkham et al., 2012.)

All collected information was based on self-evaluations. This was to enable the collection of information from broad spectrum of the behaviors and traits of the respondents.

Originally, 392 participants responded to the questionnaire. The average age of a respondent was 29.56 years (Mdn = 27.00, SD = 9.03). The youngest respondent was 17 years old, the oldest being 74 years old.

Before the statistical analyses were conducted, the sample was reduced to include only those who were under 44 years old, due to the lower Internet use rate of older age groups (Suomen virallinen tilasto (SVT), 2014). This was done as an attempt to study only those age groups to whom Internet use is a natural alternative to face-to-face interaction. After excluding those older than 44 years old, the sample consisted of 362 respondents and the mean age was 27.57 (Mdn = 26.00, SD = 5.56). Age was not normally distributed (*Kolmogorov-Smirnov* = .12,  $p < .001$ ). Of the respondents 218 (60.20 %) were women, 101 (27.90 %) were men, and 43 (11.90 %) respondents had chosen the option "other".

Nonparametric methods were used in statistical analyses, as the material did not meet the requirements of parametric tests.

## 5 RESULTS

The findings derived from the data will be presented in this section. First the question of whether SPS can explain the social preference for online interaction is addressed through all the sub-questions that were introduced in the section 4.1. Then the question of whether preference for online interaction can be considered to be beneficial to HSPs is addressed, also through several subquestions. In this section, the focus is on statistical analyses and the implications of the results are discussed in detail in the section 6.

### 5.1 The social preference for online interaction

The respondents were asked to estimate the number of hours they spend on an average day in social interaction on their free time, both online and face-to-face. The average time spent online in social interaction was 3.70 hours daily (Mdn = 3.00, SD = 2.75). The lowest reported time was 0 hours and the highest was 17 hours. Time spent online was not normally distributed (*Kolmogorov-Smirnov* = .19,  $p < .001$ ). The average time spent in face-to-face interaction was 2.87 hours (Mdn = 2.00, SD = 2.26). The lowest reported time was 0 hours, whereas the highest was 12 hours. Like the time spent online, the time spent face-to-face was not normally distributed (*Kolmogorov-Smirnov* = .21,  $p < .001$ ).

A new variable was formed by subtracting the time spent face-to-face from the time spent online. Thus, the new variable was assigned a greater positive value the more the respondent spent time online in relation to time spent face-to-face. If the respondent spent as much time online as face-to-face, the value of the variable was 0, and if they spent more time face-to-face than online, the variable was assigned a negative value. On average, the respondents spent daily nearly one hour more in online interaction than in face-to-face interaction, regardless of the total hours spent in social activities ( $M = .82$ , Mdn

= 1.00, SD = 3.53). Values of this variable ranged from -10 to 15 and it was not normally distributed (*Kolmogorov-Smirnov* = .12,  $p < .001$ ).

In order to compare those who preferred online social interaction and those who preferred face-to-face interaction, a second variable was formed based on the hours spent online and face-to-face. This variable was qualitative and consisted of five groups: 1) Those who spent a lot of time in social interaction online and only little time in face-to-face interaction (online-group, 10.50 % of respondents), 2), those who spent a lot of time in face-to-face social interaction, but only little time online (FtF-group, 13.30 %), 3) those who spent only little time in both online and face-to-face social interaction (11.90 %), 4) those who spent a lot of time both online and face-to-face in social interaction (8.30 %), and 5) those who did not fit into any group mentioned above, which consisted of most of the respondents (56.10 %). The most relevant groups for the analyses were the online-group and the FtF-group, which represented the opposite ends of the preference for online interaction.

The division into the groups was done based on the lower and higher quartiles of the variables of times spent online and face-to-face. In other words, the respondents in the online-group had their face-to-face interaction hours in the lower quartile of the face-to-face interaction time variable, but their time spent online was in the higher quartile of the distribution of the corresponding variable. The pattern was reversed in the FtF-group, in which the respondents' time spent face-to-face was in the higher quartile and time spent online in the lower quartile. Those who were not very sociable, in regards of time, either online or face-to-face, were in lower quartiles of both variables, and those who were highly sociable in both were in the higher quartiles. The lower cut-off point for the time spent online was 2 hours and 1 hour for the time spent face-to-face. The higher cut-off point was 5 h hours for the time spent online and 4 hours for time spent face-to-face.

## 5.2 Sensory-processing Sensitivity

A new variable was formed based on the mean of each respondent's HSPS scores. In the new HSPS-variable, value of 1 marked the lowest possible sensitivity and 5 the highest. The mean score of the HSPS variable in the sample was 3.42 (Mdn = 3.39, SD = .64). The variable was not normally distributed (*Kolmogorov-Smirnov* = .06,  $p = .009$ ). Based on the histogram, the distribution seemed to be bimodal (Figure 1). Aron & Aron (2013) recommends to regard HSPS as a dichotomous variable, and therefore it was transformed into a qualitative variable that contained two classes (HSP and non-HSP groups). Cut-off point for the HSP group was the highest 20 % of the HSPSs distribution and the rest 80 % were assigned as non-HSPs (Aron & Aron, 2013). The 8<sup>th</sup> decile of the HSPS, the cut-off point, was at 4.04. In the HSP group there were 74 individuals, and 288 individuals were in the non-HPS group.

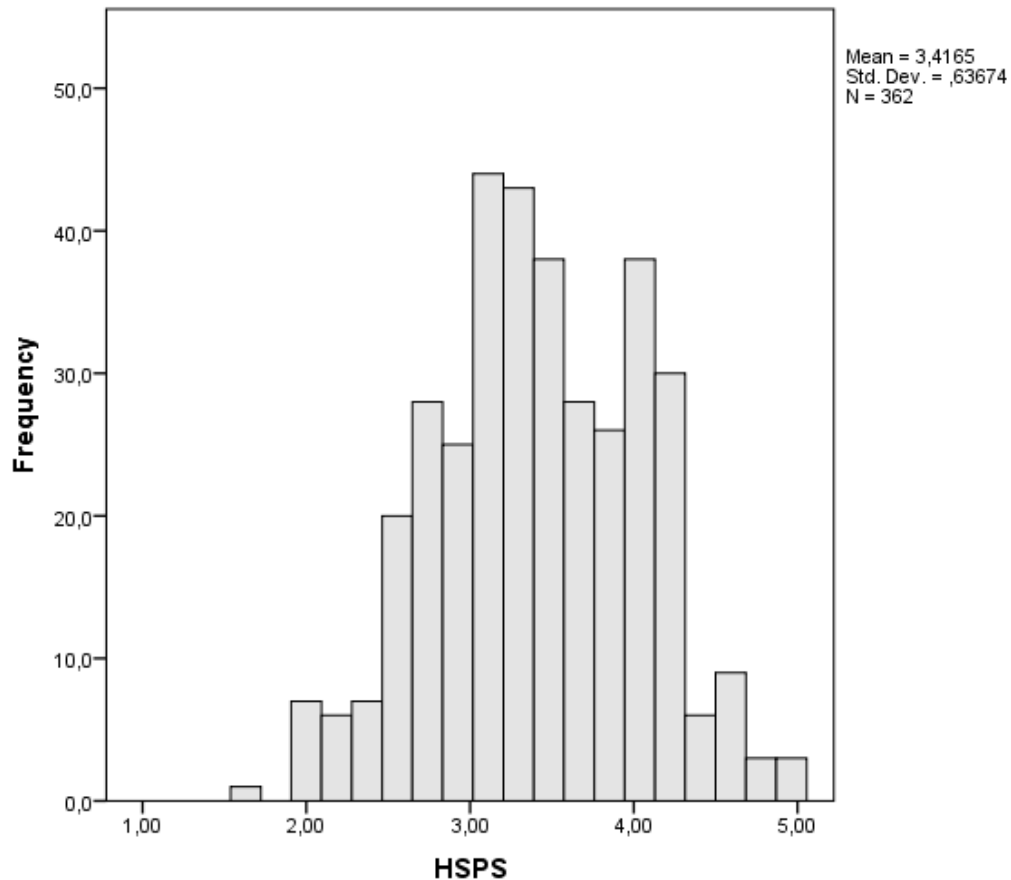


FIGURE 1: The distribution of sensory-processing sensitivity in the current sample.

The gender distribution differed in the HSP and non-HSP groups ( $\chi^2 (2) = 12.97, p = .002$ ). Of men, only 9.90 % were in the HSP group, of women, 22.48 % and of others, 34.88 %. A statistically significant difference was found between women and men ( $U = 8572.00, p = .001$ ), women and others ( $U = 3452.50, p = .01$ ), and men and others ( $U = 1059.00, p < .001$ ). The HSP and non-HSP groups did not differ in their average age ( $U = 9813.50, p = .29$ ).

### 5.3 SPS and the social preference for online interaction

When online- and FtF-groups were compared, it was found that there were no differences in the distribution of HSPs and non-HSPs in these groups ( $\chi^2 (1) = 1.24, p = .31$ ). However, when only the highest and lowest quartiles of the HSPS were analyzed, in other words, highly sensitive individuals were compared with those who were least sensitive, it was found that their distribution to FtF-



and online-groups differed ( $\chi^2(1) = 8.31, p = .004$ ). Of those who scored in the highest quartile in HSPS, 62.50 % were in the online-group and 37.50 % in the FtF-group in regards of their social preference. Of those who were in the lowest quartile of HSPS, only 14.30 % were in the online-group and 85.70 % in the FtF-group. In the following analyses, the HSP and non-HSP groups still refer to those groups where the highest 20 % cut-off point was used to classify individuals to HSPs and non-HSPs and it will be stated clearly if the lowest and highest quartile of HSPS groups were used in the analysis.

When the hours spent online in relation to those spent face-to-face were compared, it was found that the HSPs spend 1.5 hours more on average daily in online interaction than in face-to-face interaction ( $M = 1.49, Mdn = 1.00, SD = 3.90$ ) and that this differed from the non-HSP group's average ( $U = 8951.00, p = .03$ ), although they also spent more time online. The non-HSPs spent, on average, .65 hours more online than in face-to-face interaction ( $Mdn = .00, SD = 3.41$ ).

The HSP group reported higher absolute hours spent online ( $M = 4.22, Mdn = 3.50, SD = 2.83$ ) than the non-HSPs ( $M = 3.56, Mdn = 3.00, SD = 2.72$ ). This difference was statistically significant ( $U = 8984.00, p = .04$ ). Surprisingly, no difference was found when the absolute times spent in face-to-face interaction were compared between HSPs and non-HSPs ( $U = 10049.00, p = .44$ ). In the whole sample, the average time spent in face-to-face interaction daily was 2.87 hours ( $Mdn = 2.00, SD = 2.26$ ). It seems that the HSPs spent relatively more time online than in face-to-face interaction, but this was due to increased time spent online. Their face-to-face time was similar to the non-HSPs (Figure 2).

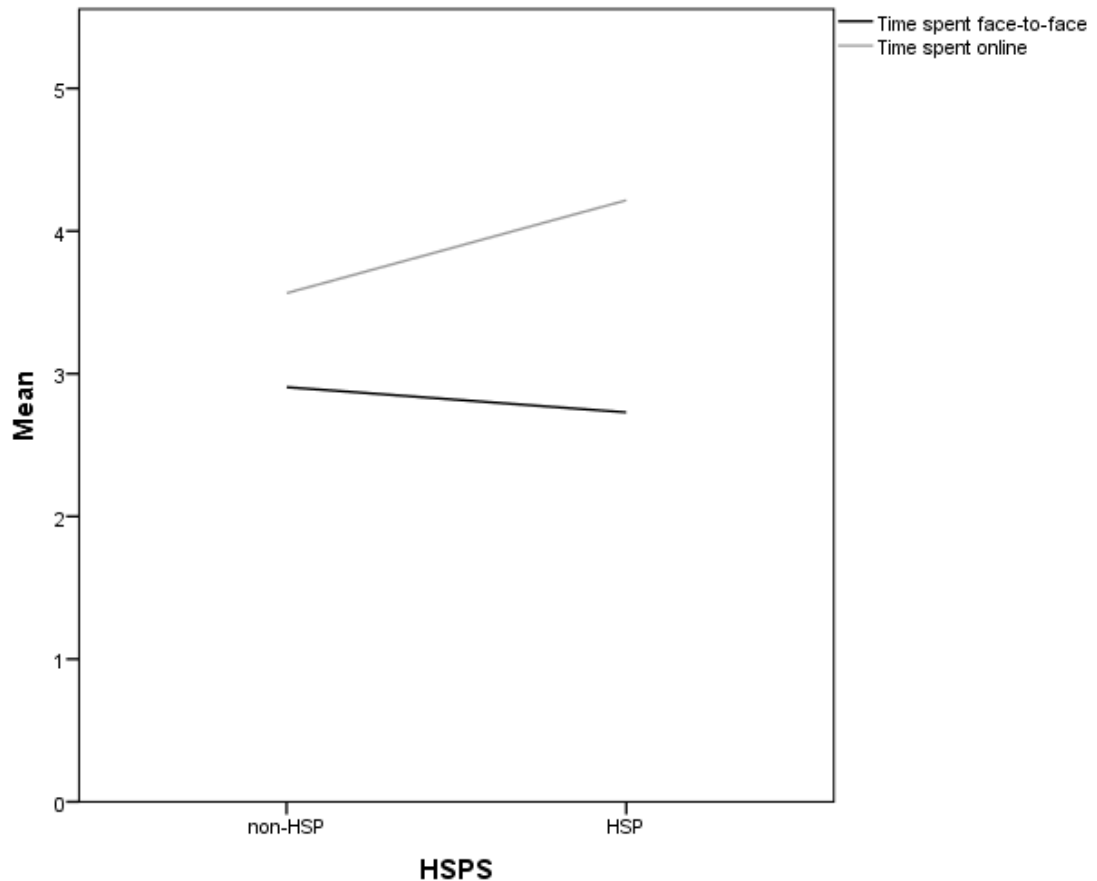


FIGURE 2: The absolute times spent in face-to-face and online interaction in the HSP and non-HSP groups.

When only those whose HSPS scores were in the highest or lowest quartile were examined, a difference was found not only in average times spent online ( $U = 2972.50, p = .02$ ), but also in times spent in face-to-face interaction ( $U = 2802.00, p = .004$ ). Total time spend in both modalities of communication did not differ between these groups ( $U = 3572.00, p = .61$ ). This means that when the highly sensitive were compared with the least sensitive, the highly sensitive preferred online interaction at the expense of face-to-face interaction (Figure 3). Those in the highest quartile of HSPS spent 4.15 hours online on average (Mdn = 4.00, SD = 2.81) and those in the lowest quartile 3.36 hours (Mdn = 3.00, SD = 2.84). The highly sensitive spent in face-to-face interaction 2.48 hours on average (Mdn = 2.00, SD = 2.13) and the least sensitive 3.42 hours (Mdn = 3.00, SD = 2.55). Gender was not associated with the preferred medium of interaction ( $\chi^2(4) = 7.25, p = .12$ ).

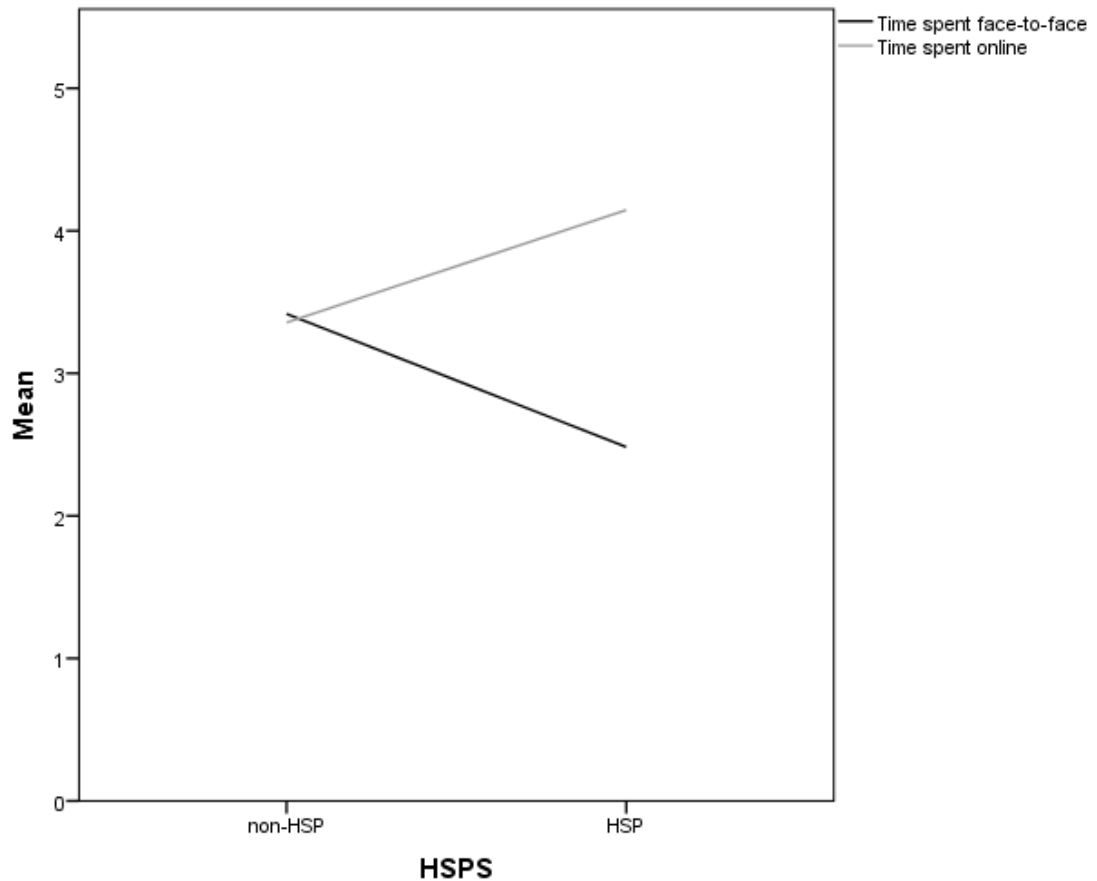


FIGURE 3: The absolute times spent in face-to-face and online interaction in the highest and lowest quartiles of HSPS.

#### 5.4 The degree to which important relationships took place in the Internet

One of the questions in the survey measured to what degree the respondents reported communicating in the Internet with persons who they most preferably interact in their free time. A new variable was formed as an average of how much the respondents interacted on the Internet with their three most preferred communication partners. The values of this variable ranged between 1 and 5. Option 1 was chosen if the interaction happened only in face-to-face settings, and 5 if the interaction happened only in the Internet. The mean for this variable was 2.68 (Mdn = 2.67, SD = .84). It was not normally distributed (*Kolmogorov-Smirnov* = .10,  $p < .001$ ).

When the HSP and non-HSP groups were compared, no difference was found in regards of in which modality their important relationships took place ( $U = 9949.50, p = .38$ ). When the lowest and highest quartile of the relationship variable was examined to find out whether the distribution of HSPs and non-HSPs was even in these groups, no difference was found ( $\chi^2 (1) = .33, p = .57$ ). Even when comparing the lowest and highest quartile of HSPs, there was no difference ( $U = 3131.50, p = .12$ ).

## **5.5 Modalities of online communication preferred by the HSPs and non-HSPs**

The survey included questions of how often the respondent used certain medium of communication while online. The values of these variables ranged from 1 to 5, where 1 was chosen if the respondent used the medium of communication always when they were online and 5 if they never used it. There was no difference in how often the HSPs and non-HSPs used text-based communication ( $U = 10312.00, p = .63$ ), audio-based communication ( $U = 9360.50, p = .086$ ), communication via webcam ( $U = 10117.00, p = .46$ ), or used synchronous ( $U = 10039.00, p = .42$ ) or asynchronous communication channels ( $U = 9734.50, p = .23$ ). When comparing how often they used audio-based communication channels, the p-value approached significant value. In this variable, the mean for HSPs was 4.23 (Mdn = 4.00, SD = .87) and the mean for non-HSPs 4.02 (Mdn = 4.00, SD = .95), so the HSPs might have used slightly less audio-based communication than the non-HSPs, although the difference was very small. No clear differences were found in the preferred mediums of online communication even when only the highest and lowest quartiles of HSPs were compared.

## **5.6 Shyness and sociability in online and face-to-face interaction**

The respondents were asked questions concerning shyness and sociability both in the Internet and in face-to-face situations. Four new variables were formed separately for shyness and for sociability in both modalities of communication. The new variables were formed from the means of questions concerning the variable. The two variables measuring shyness had values ranging from 1 to 5, where 1 stands for not shy and 5 for shy. The two sociability variables also ranged from 1 to 5, where 5 stands for very sociable and 1 for not sociable. In the whole sample, the mean for online shyness was 2.53 (Mdn = 2.40, SD = .97), for face-to-face shyness it was 2.92 (Mdn = 2.80, SD = 1.18), for online sociability

it was 3.21 (Mdn = 3.20, SD = .75), and for face-to-face sociability it was 3.18 (Mdn = 3.20, SD = .90).

It was found that in regards to face-to-face shyness, the HSPs and non-HSPs differed from each other ( $U = 5820.50, p < .001$ ). The non-HSPs had the mean score of 2.73 (Mdn = 2.60, SD = 1.14), whereas in the HSP-group it was 3.66 (Mdn = 4.00, SD = 1.04). Thus, the HSPs were considerably shyer than the non-HSPs when the social interaction took place face-to-face.

The HSPs and non-HSPs also differed in regards to online shyness ( $U = 7523.00, p < .001$ ). In the Internet, too, the HSPs ( $M = 2.96, Mdn = 2.60, SD = .99$ ) were shyer than the non-HSPs ( $M = 2.42, Mdn = 2.40, SD = .94$ ). However, especially when comparing the medians, the difference between HSPs' and non-HSPs' shyness scores was substantially smaller in the Internet (.20) than in face-to-face situations (1.40). In conclusion, the HSPs were shy in both modalities, but this difference was considerably more pronounced in face-to-face interactions (Figure 4).

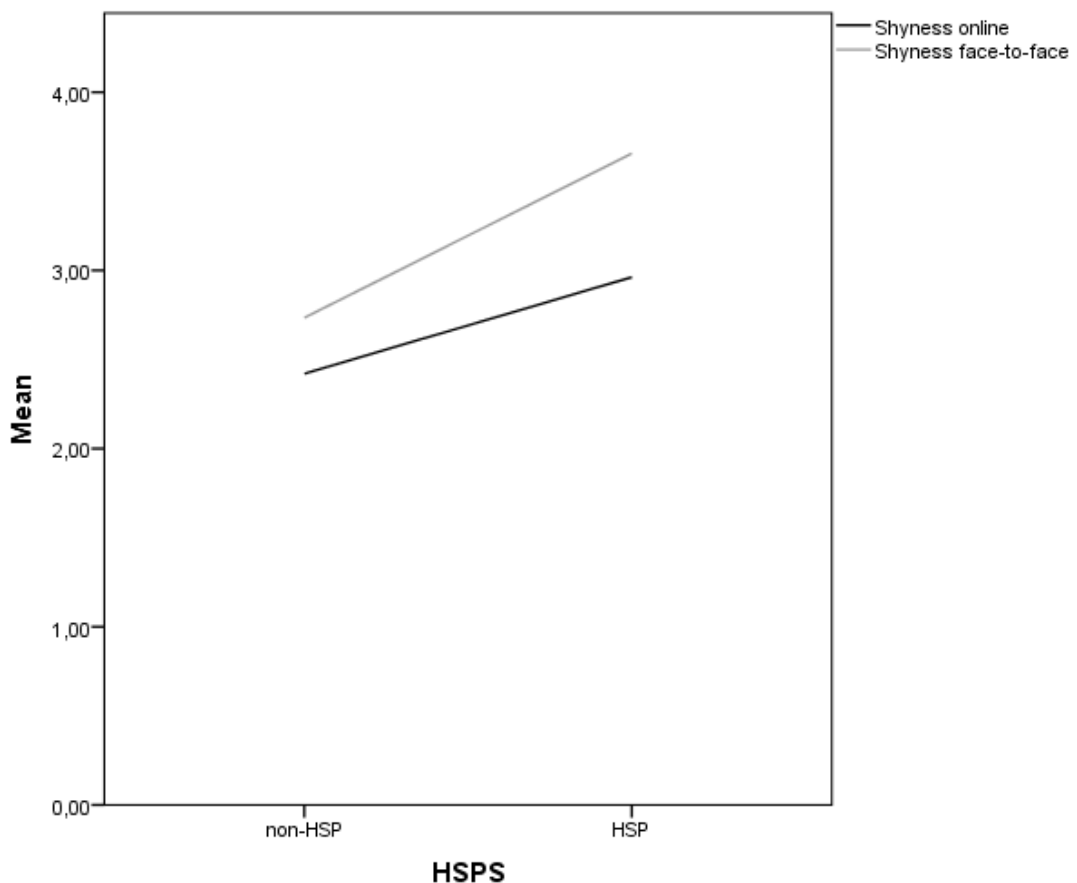


FIGURE 4: Shyness of the HSPs and the non-HSPs in the Internet and in face-to-face situations

The HSPs and the non-HSPs also differed from each other in regards to sociability in face-to-face interactions ( $U = 6962.50, p < .001$ ). The non-HSPs ( $M = 3.30, Mdn = 3.40, SD = .85$ ) were more sociable than the HSPs ( $M = 2.73, Mdn = 2.80, SD = .93$ ). However, the groups did not differ in their online sociability ( $U = 10170.50, p = .54$ ). The mean value for the online sociability in the whole sample was 3.21 ( $Mdn = 3.20, SD = .75$ ). Thus, in regards to sociability, the HSPs resembled the non-HSP more in the Internet, and also were more sociable in online interactions than in face-to-face situations (Figure 5).

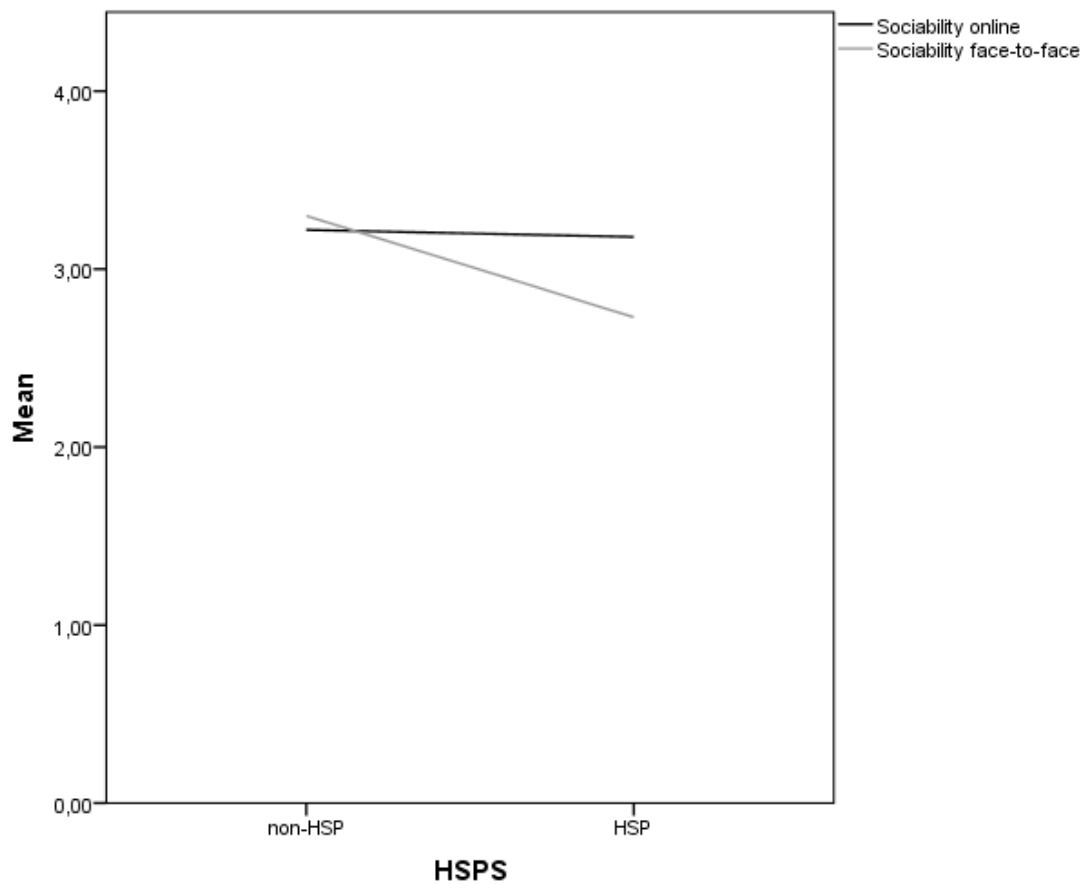


FIGURE 5: Sociability of the HSPs and the non-HSPs in the Internet and in face-to-face situations.

## 5.7 Social preference for online interaction and psychological wellbeing

The psychological wellbeing of the respondents was measured with the CORE-10 scale. A new variable was formed as a mean value of the ten questions of the CORE-10. Value of 0 stood for the highest possible wellbeing that could be measured with the scale, and 4 for the lowest. The mean value of this variable in the whole sample was 1.20 (Mdn = 1.00, SD = .77). The variable was not normally distributed (*Kolmogorov-Smirnov* = .12,  $p < .001$ ).

The HSPs and the non-HSPs differed from each other in regards to psychological wellbeing ( $U = 6461.50$ ,  $p < .001$ ). The HSPs ( $M = 1.63$ , Mdn = 1.40, SD = .81) were, on average, somewhat more distressed than the non-HSPs ( $M = 1.09$ , Mdn = .90, SD = .72).

When the online- and the FtF-groups in the whole sample were compared, a difference was found in their wellbeing ( $U = 618.00$ ,  $p = .01$ ). Those favoring online social interaction ( $M = 1.45$ , Mdn = 1.30, SD = .89) scored, on average, lower on the psychological wellbeing than those favoring face-to-face interaction ( $M = .97$ , Mdn = .80, SD = .76).

However, when the psychological wellbeing was compared only in the HSPs who belonged to the online- and FtF-groups, no difference was found ( $U = 30.50$ ,  $p = .15$ ). As a whole, the HSP-group scored 1.63 on average on the CORE-10 scale (Mdn = 1.40, SD = .81). The average score of the highly sensitive in the online-group was 2.06 (Mdn = 2.4, SD = .83) and the score of those in the FtF-group was 1.38 (Mdn = 1, SD = .94). Although not statistically significant, the difference in the mean values was substantial, and it is possible that a difference might have been detected in a larger sample. It must be noted, that this analysis included only individuals who were both highly sensitive and either in the online-group or in the FtF-group in regards of their social preference.

A summary of the psychological wellbeing of the HSPs and the non-HSPs in online- and FtF-groups is displayed in the Figure 6. It seems that the social preference for the Internet is associated with reduced mental wellbeing in both groups, and that the baseline of wellbeing is lower for the HSPs.

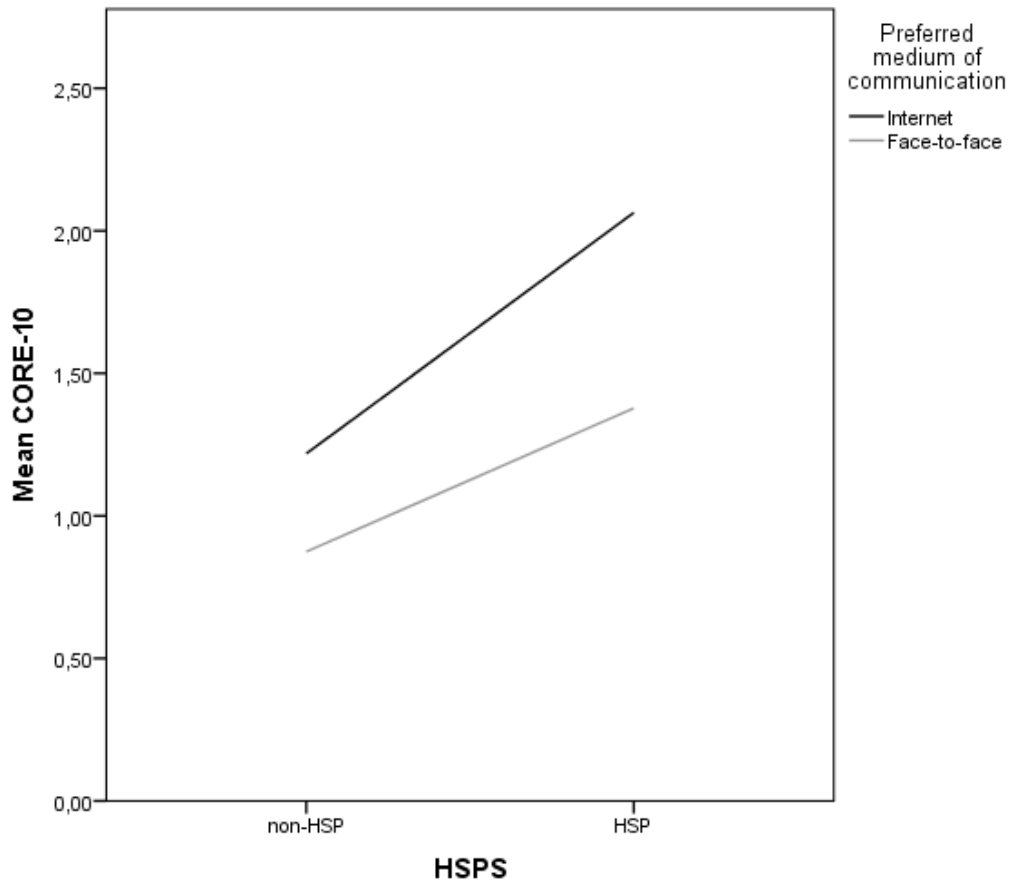


FIGURE 6: Psychological wellbeing of the HSPs and the non-HSPs in the online- and FtF-groups.

Also those HSPs who were sociable neither in the Internet or in face-to-face situations were compared with the HSPs who were in the online-group. No difference in wellbeing was found between these groups ( $U = 30.00, p = .25$ ).

As women and others were more often highly sensitive than men, the psychological wellbeing was compared in these gender groups. It was found, that these groups differed from each other ( $\chi^2(2) = 7.91, p = .019$ ). A difference was found between women and men ( $U = 8572.00, p = .001$ ), women and others ( $U = 3452.50, p = .006$ ), and men and others ( $U = 1059.00, p < .001$ ). Men had the highest psychological wellbeing ( $M = 1.10, Mdn = .90, SD = .76$ ), women slightly less so ( $M = 1.20, Mdn = 1.00, SD = .77$ ) and others the least ( $M = 1.45, Mdn = 1.20, SD = .76$ ).



## 6 DISCUSSION

The objective of this study was to investigate whether sensory-processing sensitivity can explain the preference for online social interaction and if the Internet should be considered an alternative, beneficial interaction channel for highly sensitive persons. In this final section, the research questions will be addressed using the findings derived from the data. In addition, limitations of the current study are discussed, as are proposals for future research.

### 6.1 Sensory-processing sensitivity could explain the preference for online social interaction

The first research question was that whether sensory-processing sensitivity explains why some individuals have a social preference for online interaction. The question was approached through several sub-questions, which were the question of whether there was a link between SPS and the preference to spend more time in the Internet in contrast to face-to-face interaction, the question of whether the Internet can be considered an alternative, satisfactory social medium for the HSPs in their important relationships, and finally, the question of do the HSPs and the non-HSPs differ in the modalities they prefer to use to communicate with others on the Internet. No unequivocal answer was obtained to the question of whether SPS explains the preference for online social interaction.

No difference was found in the way in which the HSPs and the non-HSPs were distributed in the online- and FtF-groups of social preference, when the cut-off point for the HSPs were the highest 20 % of the Highly Sensitive Person Scale. When the lowest and highest quartiles of the HSPs were compared, it was found that the most sensitive showed a clear social preference for online interaction whereas the least sensitive showed an opposite pattern and

preferred face-to-face interaction. This finding was in-line with the original hypothesis.

Both the HSPs and the non-HSPs spent more time daily in online social interaction than in face-to-face interaction. HSPs spent daily 1 hour 30 minutes more online, whereas the non-HSPs were online 40 minutes more on average.

Surprisingly, the HSPs and the non-HSPs spent similar amounts of time in face-to-face interaction daily. Therefore, the difference in the relative times spent online and face-to-face was due to the HSPs spending more time in the Internet than non-HSPs, but not spending less time in face-to-face situations. Essentially the HSPs showed a preference for online interaction when measured in time, but this did not happen at the expense of face-to-face social interaction. These results were observed only in the original HSP- and non-HSP-groups; again, the results were different when the highest and lowest quartile of HSPs were compared. When defined this way, the more sensitive spent more time online and less face-to-face than the less sensitive. Their online and face-to-face social interactions combined produced similar hours. Therefore, the highly sensitive and the individuals with lowest sensitivity spent similar times in social interaction, but the highly sensitive preferred the Internet as their social medium, whereas those who were not sensitive preferred traditional, face-to-face means of interaction.

Against the expectations, the important relationships of the HSPs did not take place more in the Internet than those of the non-HSPs. This does not support the idea that the highly sensitive would prefer the online environment because it would be an alternative way for them to interact with important people in their lives. Instead, it could be possible that the Internet might be used for less important relationships, and that the close relationships might be considered to be so familiar that the interaction is less straining. If this might be the case cannot be resolved in the light of the current data. It must be noted, that even though the important interpersonal relationships of the HSPs did not take place more in the Internet than those of the non-HSPs, there is some evidence for the idea of alternative social medium, as the HSPs did spend similar amounts of time as the non-HSPs in social interaction but preferred the Internet, as noted above.

The preferred modalities of communication did not differ between the HSPs and the non-HSPs, that is, there were no differences in how often they used synchronous or asynchronous communication online, or how often their communication was text-based, audio-based or took place via webcam. The difference in audio-based communication was almost statistically significant, so that the HSPs used audio-based communication little less than the non-HSPs. But even if this difference was statistically significant, the absolute difference would have been very small, and could not be considered as clear evidence for the assumption that the sensitivity to sensory stimuli was the reason the HSPs preferred online communication. It is possible that the questions concerning the online communication modalities were not precise enough, and that the results rather reflect more general trends of online communication. In addition, the

measuring was conducted via self-assessments of whether the respondents used certain modality of communication “often” or “rarely” or something in between, and thus the responses reflect the subjective experiences of the respondents, rather than objective reality of how they use these modalities.

When interpreting the data, it was taken into account that the sample might have contained a higher number of individuals belonging in a social minority group than an average sample of the population. 11.90 % of the respondents chose the option “other” when their gender was asked. It is likely that those who chose this option identify as nonbinary, that is, their gender identity lies outside the male-female binary, and therefore they belong in a gender minority. Minorities have found to be more prone to show a social preference for online interaction (McKenna & Bargh, 1998), so there was a concern of whether this might have biased the results. As mentioned earlier, the others were more often highly sensitive than men or women. However, no gender differences was found in the preference for online communication, and therefore the preference the HSPs showed for online interaction was not due to high amounts of individuals belonging to gender minorities being highly sensitive.

In conclusion, it was found that SPS was linked with social preference for online interaction, especially when the least sensitive were compared with highly sensitive. For the SPS, being likely an inherent trait, precedes the Internet use habits of an individual, it can be argued that the SPS might be an explanatory factor in the formation of individual’s social Internet using habits.

However, it must be taken into account that some factor other than SPS could be the reason that the HSPs seemed to prefer online interaction. Some of the findings indicate that this might be the case. First of all, there were no differences in the preferred mediums of online communication between the HSPs and non-HSPs - maybe the sensory load of face-to-face interaction is not the reason that the HSPs prefer the Internet. In addition, the important relationships of the HSPs did not take place in the Internet more than those of the non-HSPs. It is quite possible that the social preference for online interaction of the HSPs was due to, for example, their higher levels of psychological distress. There have been previous findings of a link between depression and the preference for computer-mediated communication (Caplan, 2003). However, the possibility that the SPS actually was the explaining factor cannot be excluded. The fact that the HSPs benefited more of computer-mediated communication in terms of shyness reduction than the non-HSPs, and that they were more sociable in the Internet might be manifestations of the effects of SPS on social interaction. Of course, there is a chance that the higher levels of psychological distress could explain these findings also, or some other factor that was not taken into account.

## 6.2 The benefits of computer-mediated communication for the HSPs are equivocal

The potential benefits of the use of computer mediated-communication for the HSPs were considered from three directions. The association between the social preference for online interaction and psychological wellbeing was examined. In addition, shyness and sociability of the HSPs and non-HSPs were examined both in online social interaction and in face-to-face situations.

No difference was found in the psychological wellbeing of those HSPs who preferred online interaction and those who preferred face-to-face interaction. Had the sample been larger, it is very possible that those who preferred online interaction might have been found to be more psychologically distressed – just the opposite of what was expected. Apparently, the use of the Internet for social purposes does not enhance the psychological wellbeing of the highly sensitive, although no causation can be inferred. Therefore, it cannot be stated that the use of the Internet for social purposes decreases the wellbeing of the HSPs, even if a significant difference would have been found. In addition, there was no difference between the online group of the HSPs and those who were not social either in the Internet or in face-to-face environment. This also points to the direction that the highly sensitive do not benefit from computer-mediated communication when it comes to psychological wellbeing.

As a whole, the HSPs experienced substantially more psychological distress than the non-HSPs. In addition, in both HSP- and non-HSP-groups, those who preferred online interaction experienced more distress in comparison to those who preferred face-to-face interaction, even though the difference was not statistically significant in the HSP group. It is interesting that in the HSP-group there might not be a difference in the wellbeing of those who prefer the Internet and those who prefer face-to-face interaction. This could be interpreted so, that the extensive social use of the Internet might not have as adverse effects for the HSPs as the non-HSPs. On the other hand, it might mean that the HSPs were initially so psychologically distressed that the adverse effects of Internet use would not be so significant that it could reduce their wellbeing even further. However, as noted before, the social preference for online interaction might not cause psychological distress at all, but rather the poor wellbeing could lead to the extensive use of the Internet for social purposes (Caplan, 2003).

It has been found that social Internet use is associated with worse outcomes, when the user interacts with strangers rather than with friends (Anderson, 1998; Bessièrè et al., 2008; Young, 1996). The HSPs did not use the Internet more to interact with important people in their lives than the non-HSPs. Therefore it is possible that they used the Internet more to interact with less-familiar people, which might be a risk factor.

Although the social preference for online interaction seems to be associated with some adverse phenomena, the HSPs seem to benefit from the

social use of the Internet in terms of shyness. Experienced shyness of the HSPs and the non-HSPs was compared in both online and face-to-face environments. The HSPs experienced more shyness in both environments, but the difference between shyness levels of the HSPs and non-HSPs was considerably smaller in online interaction. Thus, the shyness of the HSPs decreased in online environment more than that of the non-HSPs, who also experienced some decrease in shyness while online. It is plausible that this finding could be explained by the qualities of computer-mediated communication that decrease shyness in general (Caplan & Turner, 2007; Wright, 2002) and by that the highly sensitive might benefit more of these qualities (Stritzke et al., 2004).

There were somewhat similar findings concerning sociability. The non-HSPs were equally sociable in online and face-to-face environments, but the HSPs were considerably less sociable in face-to-face situations. However, the HSPs were as sociable as the non-HSPs while online. It seems that some qualities of computer-mediated communication facilitate sociability in the HSPs.

There have been earlier findings of shy individuals preferring online social interaction (Chak & Leung, 2004; Yang & Tung, 2007). As it was found that the HSPs were shyer than the non-HSPs, it is possible that shy individuals develop a preference for online social interaction at least partially because of the effects of sensitivity. The same might apply to findings that concern introverts, even though in the current study only sociability was measured and it is not perfectly overlapping construct with extraversion-introversion continuum. However, the finding that the difference in sociability of the HSPs and non-HSPs disappear in the Internet might suggest that the similar finding concerning introverts could be attributed to underlying sensory processing sensitivity.

In conclusion, computer-mediated communication can be seen to benefit the highly sensitive, as it is linked with decreased shyness and increased sociability. This effect might explain why the HSPs spent more time online in social interaction than the non-HSPs. On the basis on the current study, no definite conclusions can be made on the subject of whether the social preference for online communication is the reason for decreased psychological wellbeing of the highly sensitive, or if the psychological distress can be attributed to the sensitivity itself. It is slightly concerning that the heightened Internet use for social purposes increases the risk for problematic Internet use patterns (Anderson, 1998; Young, 1996). However, it has to be kept in mind that the preference for online social interaction does not always lead to the development of Internet addiction (Caplan, 2003). It has to be also noted that computer-mediated communication increases hyperpersonal interaction and therefore raises the quality of interpersonal relationships (Valkenburg & Peter, 2009). This can be interpreted to suggest that psychologically distressed individuals are more likely to go to the Internet for social interaction, and not that the social Internet use itself would lead to decreased psychological wellbeing.

### 6.3 Limitations of the current study

There are several limitations to the current study which have to be kept in mind when interpreting the results. One of these limitations is the unrepresentativeness of the sample. Most of the respondents were recruited via social media and it is possible that the sample included more than average number of individuals who prefer computer mediated communication. As the sample is not representative of the whole population, no conclusions were made concerning, for example, the percentage of individuals who have a social preference for online interaction. The potential unrepresentativeness of the sample might also explain why no difference was found in social preference between the HSPs and the non-HSPs when the cut-off point was the highest 20 % of HSPS scores – there might have been, for example, more highly sensitive individuals in the sample than in the whole population. This would be probable, as there was a high number of those who identified as “other” in regards of gender, and this group scored higher than average on the HSPS. The gender distribution including surprisingly high number of those who identified themselves outside male or female categories is thought to be a result of the sample being collected via social media, which reflects a certain social network and not the population of all Finnish people under age 44. Splitting the sample to highly sensitive and to the least sensitive by dividing the highest and lowest quartiles ensured that the groups really consisted of highly sensitive and non-sensitive individuals.

Probably more essential to the credibility of the current study than the sample was the way the variables were measured. In particular, it is important to keep in mind that there is no certainty if the scales measuring shyness and sociability in face-to-face and online situations actually measured the same thing in both environments. The scales that measured these variables in online interaction were formed by modifying the questions concerning face-to-face interaction to represent better the kinds of interactions that take place online, and it is possible that the questions did not measure exactly same features. Some doubts do arise concerning the reliability of the new scales, as their Cronbach’s alpha values did decrease from the original scales. Of course, this cannot explain the differences found between the HSPs and non-HSPs when comparing them on one single scale, but the possible discrepancy could have an effect when comparing shyness or sociability in online and face-to-face environments.

As stated before, the questions concerning the usage of different communication modalities online might have been too vague. It is possible that they reflected more general trends of Internet use. In addition, these habits of Internet use were measured by self-assessment, which probably decreased the accuracy of the measurement. More accurate data on the differences between the HSPs’ and the non-HSPs’ preference for certain communication modalities

could have been collected, for example, by asking the respondents to keep log for several days of their Internet use habits.

All collected data was based on self-assessments, which could have affected in general to the accuracy of the information. For example, the respondents probably were not able to estimate accurately the average hours they spend in social interaction daily in face-to-face and online situations. More detailed knowledge of these variables could have been obtained again by the respondents keeping a log of their actual behaviors for a certain period of time. However, this kind of procedure would have most likely decreased the size of the sample considerably. The size of the sample was prioritized, as a high number of participants was needed to obtain statistically sufficient number of highly sensitive individuals and especially highly sensitive individuals who prefer online social interaction.

One aspect that have to also be taken into consideration, is that all the participants were Finnish-speaking and therefore probably rather homogenous group culturally. Thus, the results of the current study cannot be generalized to all people without caution. It is known that the effect high sensory-processing sensitivity has on individual's life depends on their environment (Aron & Aron, 1997). It has been found that attitudes towards highly sensitive individuals differ across cultures. For example, in China, the classmates of a sensitive individual have more positive attitude towards them than in Canada (Chen, Rubin & Sun, 1992). The attitudes of other people likely have an effect to the formation of the highly sensitive individual's social life and this could be expected to affect their social Internet use habits.

## 6.4 Conclusion

Based on the findings of the current study, it can be stated that high sensory-processing sensitivity is linked to social preference for online interaction and this online communication can be associated with lesser time spent in face-to-face interaction. However, the important interpersonal relationships of the highly sensitive do not take place online more than those of the less sensitive. The social preference for online interaction does not improve the psychological wellbeing of the highly sensitive individuals, but no conclusion can be made of whether it reduces it. It was found that the social use of Internet enables the highly sensitive to have an environment where they feel less shy and more sociable than in face-to-face interactions. It is possible that underlying sensitivity might explain the earlier findings of shy and introverted individuals having a social preference for online interaction. However, no conclusion can be made on the basis of the current data whether the social preference for online interaction of the highly sensitive is the result of sensory-processing sensitivity

or their high psychological distress, or some other factor that was not measured.

Some questions were left unanswered and the overall picture of the sensory-processing sensitivity's effect on individual's social Internet use habits is still unclear. Some possible areas of future studies are suggested here. The most important question is whether the SPS is linked to the social preference for online interaction independently, regardless of psychological wellbeing. Secondly, to find out whether the observed preference for the Internet was actually a result of avoidance of high sensory loads, the Internet use habits of highly sensitive individuals should be researched in more detail. At the moment the assumption that SPS, and more precisely, the avoidance of high sensory loads, leads to preference for computer-mediated communication is only hypothetical. If the actual experienced sensory load could be measured, this would offer empirical proof also. Another important area of study would be to clarify the relationship between preference for online interaction and psychological wellbeing using a longitudinal study method to gain more knowledge of the possible causal relationships.

On the basis of the current study can be proposed that in different social environments, such as schools and workplaces, it should be taken into account that some individuals feel less shy and more sociable in online environments. If this was taken into account by offering opportunities to interact via computers in addition to face-to-face interaction, it might improve social relationships of some individuals. Even though the social preference for online interaction was linked with decreased psychological wellbeing, it is not known whether there is causation, and therefore it should not be deducted that this preference itself will inevitably lead to psychological distress. More plausible explanation, when considering the effects of computer-mediated communication to shyness and sociability, is that online environments enable a less straining ways of social interaction to those with high psychological distress. Thus, it is possible that increasing the opportunities for meaningful social interaction online for individuals who are uncomfortable with face-to-face interaction, might even increase their wellbeing. The experiences of an individual affect their attitude towards their own sensitivity and it has an effect to how their sensitivity affects their life, and therefore, it is essential that the highly sensitive portion of the population has environments in which they feel comfortable (Aron & Aron, 1997 ; Aron et al., 2005).



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## APPENDIX 1: THE SURVEY

Appendix 1 is the survey sent to the respondents. The survey was conducted in Finnish. The questions are presented in the same order they were in the original survey that was sent to the respondents. The questions are accompanied by their response options. Some of the questions were answered with numerical values. Here, the questions include information of which scale they belong to, but this was not present in the actual survey. Some of the questions are reversed, which was taken into account in the analysis of the data.

### 1. Ikä

### 2. Sukupuoli:

Vastausvaihtoehdot: nainen/mies/muu

3. **Kuinka monta tuntia päivässä vietät VAPAA-AJALLASI aikaa ihmisten kanssa INTERNETISSÄ?** Arvioi keskimääräinen päivittäinen aika ja pyöristä lähimpään kokonaislukuun (myös 0 käy). Ihmisten kanssa vietetyksi ajaksi lasketaan kaikki vuorovaikutusta sisältävät toimet, kuten esimerkiksi foorumiviestien lukeminen ja kirjoittaminen, sosiaalisen median käyttö tai pikaviestinten välityksellä keskusteleminen.

4. **Kuinka monta tuntia päivässä vietät VAPAA-AJALLASI aktiivisesti aikaa ihmisten kanssa INTERNETIN ULKOPUOLELLA?** Arvioi keskimääräinen päivittäinen aika ja pyöristä lähimpään kokonaislukuun (myös 0 käy). Aktiiviseksi ajanvietoksi ei lasketa sitä, jos esimerkiksi on samassa tilassa asuinkumppanin kanssa, mutta tekee omia asioitaan

5. **Ajattele kolmea ihmistä, joiden kanssa olet mieluiten tekemisissä vapaa-ajallasi. Kuinka paljon vietät aikaa kunkin heistä kanssa Internetin välityksellä?**

Vastausvaihtoehdot: En lainkaan/Hieman/Yhtä paljon Internetissä kuin sen ulkopuolella/Paljon/Keskustelemme vain Internetissä

Henkilö 1:

Henkilö 2:

Henkilö 3:

6. **Nämä väittämät koskevat käyttäytymistäsi INTERNETISSÄ. Vastaa siis väittämiin vain sen mukaan miten tunnet kun olet ihmisten kanssa tekemisissä Internetissä (esimerkiksi chatissa, foorumeille kirjoittaessa, pikaviestimissä tai sosiaalisessa mediassa).**

Vastausvaihtoehdot: Samaa mieltä/Osittain samaa mieltä/En samaa enkä eri mieltä/Osittain eri mieltä/Eri mieltä

**Ujoutta koskevat kysymykset:**

Tunnen oloni ujoksi muiden seurassa

Tunnen oloni estyneeksi muiden seurassa

Minun on helppo lähestyä muita ihmisiä

Minun on helppo tutustua vieraisiin ihmisiin

Tunnen oloni epämukavaksi keskusteluissa, joihin osallistuu paljon ihmisiä

**Seurallisuutta koskevat kysymykset:**

Pidän sellaisten Internet-palveluiden käyttämisestä, joissa voin olla tekemisissä monien ihmisten kanssa

Pidän todella toisille ihmisille puhumisesta tai kirjoittamisesta

En yleensä halua jakaa muiden kanssa Internetissä sitä mitä teen kyseisellä hetkellä (esim. mitä luen tai katson)

Tunnen itseni pirteimmäksi kun olen ihmisten seurassa Internetissä

Pidän työskentelystä muiden kanssa Internetin välityksellä

7. **Nämä väittämät koskevat käyttäytymistäsi INTERNETIN ULKOPUOLELLA. Vastaa väittämiin sen mukaan, miten tunnet kun olet ihmisten kanssa tekemisissä kasvotusten..**

Vastausvaihtoehdot: Samaa mieltä/Osittain samaa mieltä/En samaa enkä eri mieltä/Osittain eri mieltä/Eri mieltä

**Ujoutta koskevat kysymykset:**

Tunnen oloni ujoksi muiden seurassa  
 Tunnen oloni estyneeksi muiden seurassa  
 Minun on helppo lähestyä muita ihmisiä  
 Minun on helppo tutustua vieraisiin ihmisiin  
 Tunnen oloni epämukavaksi juhlissa ja suurissa ryhmissä

**Seurallisuutta koskevat kysymykset:**

Pidän siitä että ympärilläni on paljon ihmisiä  
 Pidän todella toisille ihmisille puhumisesta  
 Haluan yleensä tehdä asioita mieluummin yksikseni  
 Tunnen itseni pirteimmäksi ihmisten seurassa  
 Työskentelen mieluummin muiden kanssa kuin yksin

**8. Highly Sensitive Person Scale: Vastaa seuraaviin väittämiin sen mukaan, miten hyvin ne sopivat sinuun.**

Vastausvaihtoehdot: Samaa mieltä/Osittain samaa mieltä/En samaa enkä eri mieltä/Osittain eri mieltä/Eri mieltä

Rasitun helposti voimakkaista aistiärsykkeistä  
 Huomaan hienovaraiset yksityiskohdat ympäristössäni  
 Muiden ihmisten mielialat vaikuttavat minuun  
 Olen tavallista herkempi kivulle  
 Huomaan kiireisinä päivinä haluavani vetäytyä lepäämään sänkyyn, pimennettyyn huoneeseen tai muuhun paikkaan jossa voin olla rauhassa  
 Olen erityisen herkkä kofeiinin vaikutuksille  
 Rasitun helposti sellaisista asioista kuin kirkkaista valoista, voimakkaista hajuista, karkeista kankaista tai läheltä kuuluvasta sireenin äänestä  
 Minulla on rikas ja monimuotoinen sisäinen elämä  
 Kovat äänet tekevät oloni epämukavaksi  
 Liikutun syvästi taiteesta tai musiikista  
 Hermoni tuntuvat joskus niin rasittuneilta, että minun on saatava olla itsekseni  
 Olen tunnollinen  
 Hätkähdän herkästi  
 Hermostun, jos minun täytyy tehdä paljon asioita lyhyessä ajassa  
 Kun toisilla on epämukava olo fyysisessä ympäristössä, tiedän usein mitä pitäisi tehdä että heidän olonsa olisi mukavampi (esim. muuttaa valaistusta tai istuinten paikkaa)  
 Ärsyynyn kun ihmiset yrittävät saada minut tekemään liian monia asioita samanaikaisesti

Yritän kovasti välttää virheiden tekemistä tai asioiden unohtamista  
 Pyrin aktiivisesti välttämään väkivaltaisia elokuvia ja tv-ohjelmia  
 Tulen epämiellyttävän virittyneeksi kun paljon asioita tapahtuu ympärilläni  
 Kova nälkä aiheuttaa minussa vahvoja reaktioita, kuten haittaa keskittymistäni tai mielialaani  
 Elämänmuutokset saavat minut pois tolaltani  
 Huomaan hienovaraiset hajut, maut, äänet sekä taideteokset ja nautin niistä  
 Minusta on epämiellyttävää kun meneillään on paljon asioita  
 Pidän tärkeänä järjestää elämäni siten, että voin välttää tilanteita jotka saavat minut pois tolaltani tai ovat hyvin kuormittavia  
 Voimakkaat ärsykkeet, kuten kovat äänet tai kaoottiset näkymät häiritsevät minua  
 Kun joudun kilpailemaan tai minua tarkkaillaan suorituksen aikana, hermostun tai alan tärinäni, että suoriudun paljon huonommin kuin tavallisesti  
 Kun olin lapsi, vanhempani tai opettajani pitivät minua herkkänä tai ujona

9. **CORE-10:** Seuraavat väittämät koskevat sitä, miten olet voinut viimeisen viikon aikana. Lue jokainen väittämä ja arvioi sitä, miten usein olet kokenut kyseisellä tavalla viimeisen viikon aikana. Valitse vaihtoehto, joka on lähimpänä kokemustasi.

Vastausvaihtoehdot: Ei/En lainkaan/Vain satunnaisesti/Silloin tällöin/Usein/Suurimman osan ajasta tai jatkuvasti

Minusta on tuntunut jännittyneeltä, ahdistuneelta tai hermostuneelta  
 Minusta on tuntunut siltä, että minulla on joku jonka puoleen kääntyä kun tarvitsen tukea (käännetty)  
 Olen tuntenut itseni kykeneväksi selviytymään, kun asiat menevät pieleen (käännetty)  
 Ihmisille puhuminen on tuntunut liian kuormittavalta  
 Olen tuntenut paniikkia tai voimakasta pelkoa  
 Olen tehnyt suunnitelmia elämäni päättämiseksi  
 Minun on ollut vaikea nukahtaa tai pysyä unessa  
 Olen tuntenut oloni epätoivoiseksi tai avuttomaksi  
 Olen kokenut oloni onnettomaksi  
 Ei-toivotut mielikuvat tai muistot ovat vaivanneet minua

**10. Kuinka usein kommunikoit Internetissä seuraavilla tavoilla**

Vastausvaihtoehdot: Aina kun käytän Internetiä/Usein/Silloin tällöin/Harvoin/En koskaan

Tekstin välityksellä

Äänen välityksellä (esim. Skype ilman nettikameraa)

Nettikameran välityksellä

Reaaliajassa (Tällä tarkoitetaan sitä, että keskustelu tapahtuu samassa tahdissa kuin keskustelu kasvokkain tapahtuisi. Esim. chatit, IRC.)

Ei-reaaliajassa (esim. foorumikeskustelut)