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## Exploring the Influence of Personality Traits on Affective Customer Experiences in Retailing: Combination of Heart Rate Variability (HRV) and Self-Report Measures

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**Abstract.** As a result of changes in customers' shopping behaviors and a corresponding increase in omnichannel behavior (i.e., a blend of online and offline channels), a good customer experience (CX) is crucial for retailers' success. Affective CX responses are especially crucial in impacting a company's marketing outcomes, such as a high level of future purchase intentions. Here, we hypothesize that a customer's affective CX is significantly influenced by his or her personality traits. Based on this hypothesis, we plan to collect physiological data (heart rate variability) and self-report data to study affective CX. Specifically, we will examine the relationship between personality traits, affective CX, and future purchase channel choice intentions. Based on the findings, we will then formulate academic and managerial implications.

**Keywords:** Customer Experience, NeuroIS, HRV, Retail, Emotions

### Introduction

Due to newly available shopping channels (e.g., the internet, mobile apps, or augmented reality), Customer Experience (CX) research including various channels (so-called omnichannel experiences) is of growing importance for academics and retailers alike [1–5]. In particular, affective CX is highly researched and can significantly influence customers' purchase intention (e.g., [4, 6–8]) and satisfaction [9, 10]. Yet, the field is dominated by traditional methods such as self-reports [2, 11, 12]. Against this background, we follow explicit calls (e.g., [2, 12–14]) to advance the CX research field in the Neuro-Information-Systems (NeuroIS) direction by combining heart rate variability (HRV) and self-report measurements. HRV indicates the variation of the time between consecutive heartbeats and reflects the heart's ability to quickly respond to changing circumstances [15]. As such, it can help to understand the current status of the autonomic nervous system (ANS) [15] as well as affective responses (i.e., stress [16] or other affective states such as amusement [17]). Importantly, personality

traits such as the Big Five can also shape emotions [18], and, at least partially, predict HRV responses [19–21] (e.g., *Neuroticism* is linked to reduced HRV [22]).

A wide range of literature investigates the influence of personality on stress (i.e., the impact of *Neuroticism* on physiological stress responses; for a meta-analysis, see [16]). However, literature examining the impacts of the Big Five on affective CX in general, and positive affective CX in particular, is still limited [11, 23], and further calls have been made to systematically study the influences of individual factors such as personality on CX (e.g., [2, 24–26]). Within this context, the proposed study aims to extend the literature by (i) measuring CX through questionnaires *and* physiological (HRV) measurement, (ii) examining the effects of the Big Five on affective CX and future purchase channel choice intentions, and (iii) including online as well as in-store customers. Hence, the study addresses two research questions:

**RQ1:** How can HRV and self-report methods be combined to measure affective CX?

**RQ2:** How do the Big Five influence affective CX and future purchase channel choice intentions in online and in-store shopping settings?

## Theoretical Background

**Personality Traits and Affective CX.** In 1963, Eysenck [27] formulated the theory that personality has a biological basis, and the extended literature has provided evidence that differences in HRV can provide valuable insights for personality and emotions research (e.g., [28, 29]). In a meta-analysis, Chida and Hamer [16] analyzed 27 studies examining determinants of HRV variations and found that anxiety, *Neuroticism*, and negative affect were associated with decreased HRV in stress situations. This finding is in line with a study by Čukić and Bates [22], who concluded that a higher level of *Neuroticism* was associated with a decreased HRV in both a resting- and stress-condition. However, other studies reported nonsignificant findings for a relationship between personality and HRV (e.g., in a stress context [21, 30, 31], or in daily life [29]). Evans et al. [30] did not find that *Neuroticism* and *Extraversion* impacted HRV, yet extroverts showed lower levels of cortisol reactivity.

Personality may not only exert influence on biological processes such as HRV, but may also shape a person's affective tendencies [18] as well as purchase channel choices (e.g., [32]). Extroverts are characterized by sociability, activity, and seeking pleasurable and enjoyable experiences [18]. Initial evidence suggests that extroverts share hedonic shopping values; namely, they enjoy shopping and feel excited about it [33]. People high in *Extraversion* were found to spend more time and money at shopping malls [34] and did not only shop for necessities (e.g., groceries) but were prone to shop for other goods like shoes and clothing [35]. Hence, we hypothesize:

1.1 **H1:** *Extraversion* positively affects a customer's affective CX as measured through HRV and self-report for (a) online and (b) in-store customers.

*Agreeableness* was also linked to hedonic shopping values; people high in *Agreeableness* showed a preference for ludic and aesthetic shopping environments [33]. Addi-

tionally, Goldsmith [35] found that *Agreeableness* indirectly (via happiness) influenced the preference to go shopping for shoes and clothing. Hence, we propose:

**H2:** *Agreeableness* positively affects the customer's affective CX as measured through HRV and self-report for (a) online and (b) in-store customers.

*Openness to Experience* is defined as being imaginative, sensitive, and intellectually curious, as well as loving the arts and beauty [18]. This characterization is in line with preliminary findings by Guido [33], who linked this personality trait with hedonic shopping values. The researcher concluded that people high in *Openness to Experience* valued aesthetically appealing shopping environments. Moreover, findings by Goldsmith [35] indicated that people high in *Openness to Experience* did not only shop for groceries, but enjoyed shopping for other goods such as clothing and shoes, indicating that shopping was not only seen as a necessity. Hence, we argue that people high in *Openness to Experience* show a higher tendency to experience a positive CX and propose:

**H3:** *Openness to Experience* positively affects the customer's affective CX as measured through HRV and self-report for (a) online and (b) in-store customers.

*Conscientiousness* is characterized by being well-organized and structured [18]. In line with these tendencies, Guido [33] and Gohary and Hanzaee [36] suggest that people high in *Conscientiousness* are functional, task-, and goal-oriented (utilitarian) shoppers. Hence, in contrast to, for example, extraverts, we suggest that people high in *Conscientiousness* experience a less positive CX:

**H4:** *Conscientiousness* negatively affects the customer's affective CX as measured through HRV and self-report for (a) online and (b) in-store customers.

*Neuroticism* is especially linked to strong emotional responses [27] such as anxiety, negative emotions, and psychological distress [18]. Guido [33] concluded that people high in *Neuroticism* were utilitarian shopping motivated; hence, their reason to shop was often goal- and not enjoyment-driven. Hence, we propose:

**H5:** *Neuroticism* negatively affects the customer's affective CX as measured through HRV and self-report for (a) online and (b) in-store customers.

**Affective CX and Neurophysiological Measurements in Consumer Emotions Research.** A few researchers have used physiological tools to measure customer emotions (see [11], [37], and [14] for a review). Ahn and Picard [38] as well as Popa et al. [39], for example, observed facial valence to study product preferences (i.e., a customer's liking of a product). Further, Kindermann and Schreiner [13] used the implicit association test (IAT) to measure customers' emotions towards brand stimuli (e.g., logos). Additionally, Guerreiro et al. [40] used skin conductance and eye-tracking to determine customers' visual attention and emotional arousal in product choices. However, using physiological measurements in the context of affective CX is still limited, and researchers call for future research in this domain (e.g., [2, 12–14]).

HRV is a standard indicator when examining parasympathetic influences on the heart [41]. Researchers suggest that HRV can be used to assess emotional responses

[42]. A meta-analysis of HRV studies suggests that most positive emotions such as amusement and joy show increased HRV, while most negative emotions such as anger, anxiety, and fear show decreased HRV [43]. Recently, Wu et al. [17] found that participants' root mean square of successive differences (RMSSD), a major HRV measure, was significantly larger for amused participants, and amusement led to a decrease in a participant's heart rate. Yet, the researchers did not find differences in HRV for fearful, neutral, or angry participants. This finding is in line with Steenhaut et al. [31], who asked participants to watch sad and happy film clips. Results showed that the higher a participant's reported negative emotionality, the higher their HRV. This finding, however, is not in line with most existing studies. Thus, we propose:

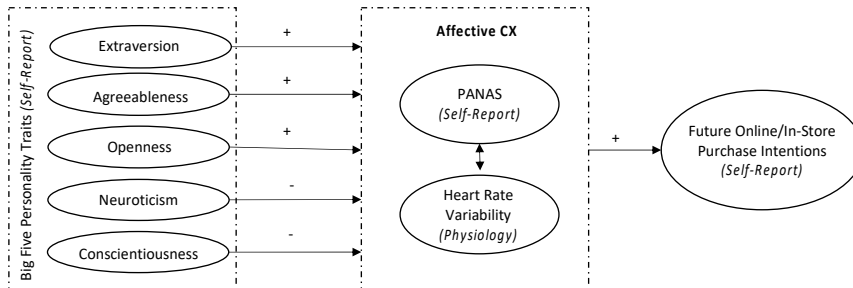
**H6:** People with higher (lower) positive affective CX (as measured through a questionnaire) show an increased (decreased) HRV for (a) online and (b) in-store customers.

1.2 **Affective CX and Future Purchase Intentions.** The extant literature shows that affective CX can impact a customer's level of satisfaction with online shopping as well as with retailers' apps [9, 10, 44–47]. Moreover, customers with positive emotions such as pleasure and enjoyment were more likely to shop at a grocery store and also perceived higher hedonic value (e.g., a more enjoyable interaction with the retailer) [48, 49]. Hence, mounting evidence suggests that a positive affective CX positively impacts future customer shopping intentions (see [50] for a review). Hence, for online and in-store shoppers we hypothesize:

**H7:** A customer's level of positive affective CX as measured through HRV and self-report positively impacts future purchase intentions for (a) online and (b) in-store customers.

### Proposed Method

1.3 **Research Model.** The goal of this study is three-fold. First, we investigate the role of the Big Five on affective CX and purchase channel choice intentions. Second, our research design examines online as well as in-store behavioral intentions. Third, we will measure affective CX through self-report and HRV. Fig. 1 visualizes the overall research framework.



**Fig. 1.** Envisioned overall research framework.  
 CX = Customer Experience, PANAS= Positive and Negative Affect Schedule

**Participants and Procedure.** This study will be conducted together with a grocery retailer and participants will be asked to shop at the retailer’s online and physical shop. In cooperation with this company, we will recruit 40 participants, of which 20 participants will shop in-store and 20 online (for further information on sample size in HRV research, see [51]). Participants must be healthy without neurological and psychiatric disorders, not using any medications, and show a normal level of physical activity. As demonstrated by previous studies (e.g., [22]), we will control for age, sex, height, weight, and BMI. On the day of the experiment, we will first inform the participants that this study focuses on CX and shopping behavior and then participants will be asked to sign the informed consent if they agree to take part. Next, we will measure the baseline heart rate (the participant not performing any task) for each participant. Because a participant’s posture (e.g., sitting vs. lying [52]), as well as walking (e.g., [53–55]) affects HRV, the baseline will be taken for the online group in a sitting condition and for the in-store group in a normal walking condition. In both conditions (online as well as in-store), participants will then be given a shopping task. All in-store shoppers will be given the same shopping list (the list will include a fixed number of light-weight grocery products, e.g., an apple or a yogurt). Next, participants will be asked to enter the store, collect the products, and place them directly into the shopping cart. After collecting all products, participants will check out at the cash register. After the check-out, the in-store shoppers will be asked to complete a questionnaire. Online shoppers will be provided with a computer (with the grocers’ website already opened) and they will receive the same shopping list as the in-store shoppers. Next, the online shoppers will be asked to find and put all the products from the list into the online shopping basket. Finally, participants will be asked to check out. After the check-out, the online shoppers will also be asked to complete a questionnaire.

**Measures.** As demonstrated by other researchers (e.g., [56, 57]), we will collect HRV through a chest belt (Polar H7, linked to a smartphone app) to measure affective CX physiologically. We choose HRV because it is less obtrusive than other physiological measures, easier to use, widely accessible, and inexpensive [51]. Thus, the introduced methods enable scientific researchers, as well as retail marketing and CX practitioners, to employ these methods in future research and evaluation studies. At the end of the experiment, participants will be asked to complete a questionnaire to assess the constructs via self-report measurements. We will use established and validated scales, including the German Big Five Scale by Rammstedt and Danner [58] as well as Breyer and Bluemke’s [59] German translation of the Positive and Negative Affect Schedule (PANAS, [60]) to measure affective CX. Lastly, purchase intentions will be assessed (scale adapted from [61, 62]).

**Data Analysis.** Data will be separately analyzed for in-store and online participants. Various indicators from electrocardiography (ECG) recordings can help to analyze HRV data [41, 63]. Most of these indicators can be divided into a time-domain or a frequency-domain of the signal [51]. Indicators within the time-domain mainly focus on the time intervals between subsequent normal QRS complexes such as the duration of a heartbeat (also known as normal-to-normal R-R interval, NN) [63]. Following Baumgartner et al. [57], we will focus on five indicators, three from the time-domain and two from the frequency-domain. As time-domain indicators, we will calculate the SDNN as the standard deviation of the signal's NN intervals as well as the SDANN as the standard deviation of the averages of the signals' NN intervals (calculated over specific periods). As the last indicator from the time-domain, we will calculate the RMSSD, which considers the differences of subsequent NN intervals. These differences are first squared and, in a second step, these squares are used to calculate the square root of the arithmetic mean [57]. Moreover, as suggested by Baumgartner et al. [57], we will consider two indicators from the frequency-domain, namely the LF as the signal's power in the low-frequency spectrum (0.04 to 0.15 Hz) and the HF as the signal's power in the high-frequency spectrum (0.15 to 0.5 Hz). As demonstrated by Baumgartner et al. [57], we plan to clean the data through the Kubios HRV software, which allows for artifact removal/correction based on certain thresholds (e.g., missed beats), and further provides the ability to analyze time and frequency domains. It should be noted that data cleaning is especially important when employing consumer-grade devices to measure HRV. Even though automatic cleaning is possible, a human investigator is necessary to identify appropriate threshold values for the particular data set to avoid over-correction (see also [57]).

### **Expected Outcomes and Conclusion**

This study aims to answer the research questions “RQ1: How can HRV and self-report methods be combined to measure affective CX?” and “RQ2: How do the Big Five influence affective CX and future purchase channel choice intentions in online and in-store shopping settings?”. To do so, we invite participants to perform a shopping task in either a physical retailing location (in-store shopper condition) or an online shop (online shopper condition). We plan to measure participants' affective CX through HRV and self-report measures. Additionally, we will examine participants' Big Five personalities as well as their future purchase intentions.

The findings from the study will provide implications for other researchers as well as retailers. We hope to provide theoretical contributions for future CX researchers, and we hope this study will spark an interest in more research within the domain of how personality impacts CX and how neurophysiological methods such as HRV can be used to measure affective CX. Further, if retailers know how personality influences affective CX and purchase channel choice, they can optimize their channels accordingly.

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