DE GRUYTER OPEN
Foundations of Management, Vol. 10 (2018), ISSN 2080-7279
DOI: 10.2478/fman-2018-0009

EMOTIONAL STATE OF CONSUMER IN THE URBAN PURCHASE: PROCESSING DATA

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Abstract: The research aims to assess the emotional state of the consumer during the purchase process in the urban retail chains. Galvanic skin response (GSR) and heart beat per minute (BPM) are used to assess the effect of environment on emotional fatigue of the consumer during shopping. Stress index was used for evaluating the results of different shops visited by a consumer. The conceptual framework of emotional fatigue research has been presented. The method was also used to estimate the level of emotional fatigue of a consumer during his or her visit to any shop on each purchase stage. The results can improve the quality of trade services by creating more favorable environment for shopping, planning sales areas, shops, sales analysis, advertising campaigns, and analysis of customers' behavior. Developing a method to process and assess a consumer's emotional state in purchase elements extend the neuromarketing theory by including the real environment component in it.

Keywords: consumer, emotion, state, purchase, GSR, BPM.

JEL: M31, M39, C93, D19, L69.

1 Introduction

The phenomenon of consumer emotional fatigue is not new in the marketing theory and practice, but very limited literature is available on it. Very few studies on human behavior are conducted in a real environment. Much less use medical equipment for measuring emotions fatigue and none that make it. Field experiments allow to obtain a better result in comparison with traditional methods: observation, interviews, and experiment. However, consumer researchers have never been able to directly record the internal emotional fatigue processes in real purchase conditions and assess. It is always been limited to designing experiments. We conducted several real purchase experiments that give the opportunity to make particular conclusions depending on the market environment.

Research gives evidence of the influence of purchase process on the consumer's emotional state and his or her fatigue during shopping, so the different elements of purchase process could create emotional drivers of the consumer. It is undoubtedly complemented by the existing theories of consumer behavioral in context of emotional fatigue. The experiment results are based on the galvanic skin response (GSR) and pulse meter.

2 Theoretical background

Generally, the methods are divided into three main approaches: observation (Jorgensen, 1989), interviews (Seidman, 2006), and experiment (Cox & Cox, 2002; Maxwell & Delaney, 2004; Martin, 2008).

The main disadvantage of these methods is the individual information in the answers of respondents. It is expressed in their thinking in a certain period of time and does not reflect the real processes that are going on in their mind. In such circumstances, the evaluation of the trade service will be different in each study and subsequently will cause errors and inconsistencies in experimental data. Data obtained in such a way is always been in doubt.

Test methods allow getting quantitative descriptions of processes that do not correlate to the physiological characteristics of the tested person (Maxwell & Delaney, 2004; Leary, 2008; Anderson & Borkowski, 1977; Richins, 1997). They are defined as the ratio of the duration of the tests performed and the number of errors.

However, the usage of only test methods for the assessment of the human condition and the degree of fatigue is inadequate.

Nowadays, the study of human interaction with the technical means is active using online experimental methods (Chebykin, et al., 2008; Tricoche, 2006; Denes & Pizzamiglio, 1999; Oshumi & Ohira, 2010; Braithwaite, et al., 2013): method of recording the electrical activity of the heart ElecroCardioGraphy (ECG); Appelhans & Luecken, 2006), method of the detecting of GSR (Perala & Sterling, 2007), method of recording the activity of the musculoskeletal system of a person, method of detecting the activity of human respiratory system, method of recording the activity of the brain ElectroEncephaloGraphy (EEG), method of psychophysical tests of attention of the person (Cannon, 1927), method of detecting the changes in GSR (Calder, 1996). Pros and Cons of different measures have been analyzed by Varan et al. (2015). Noble (2013) presented three different basic types of neuromeasures: neurometric methods that directly measure brain activity; biometrics to measure the activity in the rest of the body; indirect measures to measure the brain activity.

GSR is successfully used for monitoring various human activities (diagnostics of the functional state) in studies of emotional, volitional, and intellectual activities (Perala & Sterling, 2007). As a result of these resercher were: stressful reaction on different stimuli (Carlbring, et al., 2007); a significant increase of the electrical conductivity of the skin during the emotions of fear in comparison with anger emotions (Adolphs, 2002), emotions rising while working with Cell phone applications (Morris, et al., 2010); job activity stress (Bakker, et al., 2011); increase of driver's GSR during the perception of traffic flow information on the road (Prasolenko, et al., 2017). As a result of these studies, it was found that a sharp drop in skin resistance is a signal for emotional activation in the moment of taking a decision and, conversely, increase in skin resistance indicates emotional rest. Similar approach has been used in the analysis of customers in our previous research (Halkin, 2016). But the measurements were limited by visiting of only 2 shops in 1 trip.

Today, the cognitive aspects of the cardiorhythm are explored, and the mental state (Baevskiy, 1997) and the peculiarities of the cardiorhythm are combined (Hagit, et al., 1998). It has been examined and described in different design-making processes on prices, promotions, and impulse buying (Baumeister, 2002), for example, car selling (Danziger, et al., 2011). Changes in consumers' emotional state on different daytime were described by Chebat, Dubé, and Marquis (1997) and Kerkhof (1998).

However, existing methods never identify a consumer's reaction to different elements of the purchasing process and could not assess the consumer's emotional state on it online. Moreover, the obtained researched data have to be evaluated and assessed for further application and comparing different stores. Therefore, the aim of the research is to study the emotional state of the consumer on different elements of purchases process. Therefore, the specific objectives of this paper are:

1) to develop a method for assessing a consumer's emotional state, including purchase process elements;

2) to conduct the experiment in different people who visit different shops and evaluate their emotional state during different elements of purchase process;

3) to process the obtained data and design a method to compare information on different shops and emotional state in them.

3 Methodology

3.1 Method statement

There is no doubt that human body has created any special reaction in purchase process of visiting a certain shop (Halkin, 2016). Conveniences inside of the shops, the layout of goods, the number of open cash desks, non-stressful atmosphere, and polite and pleasant staffs have impact on consumer's emotional reaction during searching and selecting of goods and making a purchase decision. The route to shop and back has a lot of stimulus (crossroads, distance, illumination, security, safety, etc.) that has influence on consumers' emotional state and their fatigue on way to shop and back. We divided our experiment into 6 stages (Fig. 1) to evaluate human reaction in each case separately.

Information obtained from the equipment simultaneously with video recording was analyzed, and the results putting into fatigue assessment designed was approached.

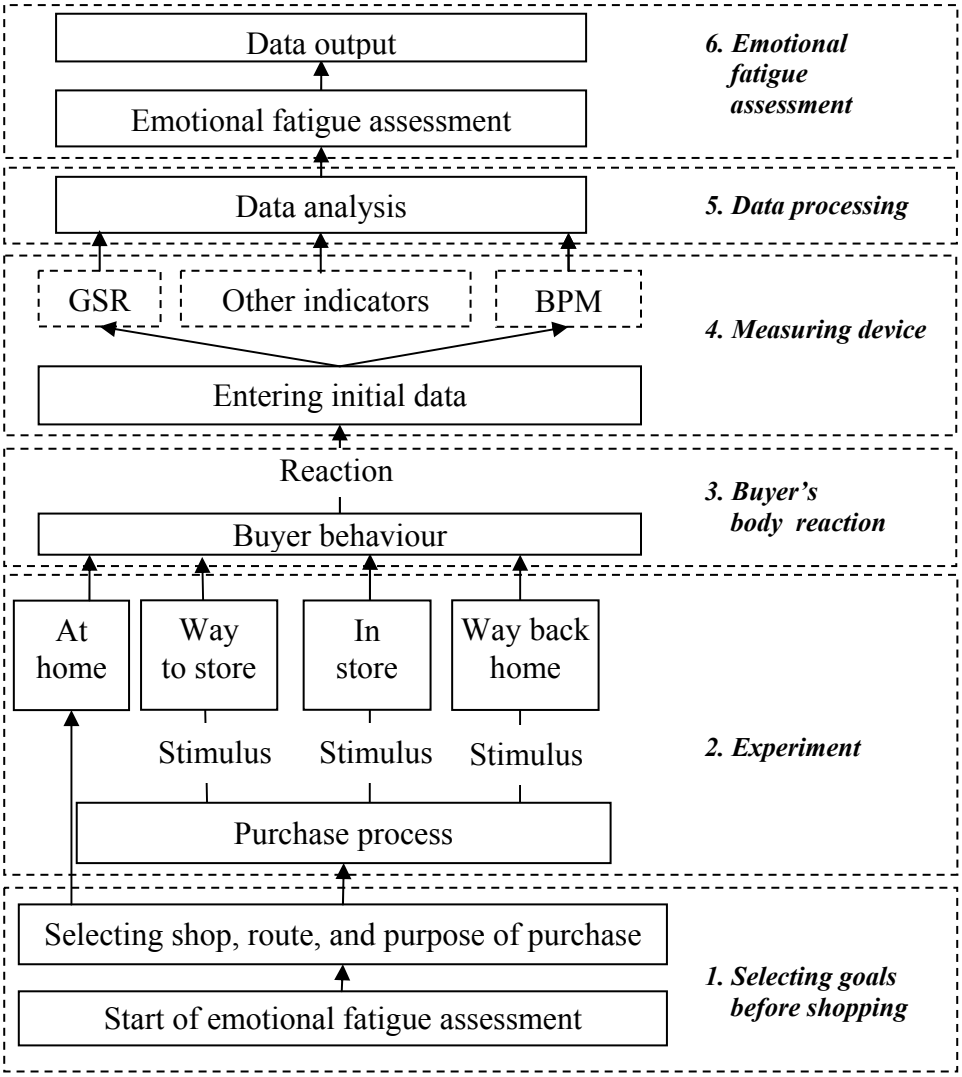

Figure 1. Conceptual framework of emotional fatigue research

The overall conceptual model was described in 6 stages:

1) Selecting goals before shopping

Before the start of experiments, the shop, route, and the purpose of purchase were selected in the first stage.

2) Experiment

Background fatigue in the initial state (baseline value of indicators before leaving home) indicates a certain level of activity of the organism, its ability to respond to stimulus. In fact, the background level value indicates how many information can be received from a consumer at present.

A very low level of emotion hinders the perception of information, and much higher overloads the customer. Measurement were performed at the start of the element of the purchase process and at the end of it.

3) Consumer's body reaction

Any consumer, in the process of purchase, perceives a steady flow of information, where he or she must not only finds the right one but also recycles it, analyzes it, takes appropriate decision, and starts some actions to realize it.

His or her mind is occupied by the processes of constant selection and comparison of alternatives. In such circumstances, after spending several hours in the shopping centre, it is more difficult to select the desired product and make a purchase, and 90% of purchases that are made in such state are vain.

Ron Baumeister and John Tierney (Baumeister & Tierney, 2011) described in detail the essence of the fatigue phenomenon caused by taking decisions.

4) Data manning

To assess consumer's background emotional fatigue during purchase process, a sample was made before exiting from home (GSR value) and compared with end-state value – after coming back. The change between two values indicates the increase in consumer's background emotional fatigue level.

Also, current human biometrics performances (mode of R-R intervals, the amplitude of a mode, R-R variation scope) were compared with normal state. According to this, the body state has been assessed.

5) Data processing

For understanding the changing emotional fatigue, a shift of level of consumer's emotional reaction was used (Lobashov, et al., 2015) as emotional component and stress index was used (Baevsky, 1984) as fatigue component (detailed in Section 3.4). The shift between measurements indicates emotional fatigue of a consumer at current element. Existing of the delta in GSR and pulse measuring at the start and the end of every experiment indicates rising of signals. This indicates that consumer's emotional fatigue appears and grew up in this process.

6) Emotional fatigue assessment at different shops

The result of measurements is to develop benchmark for how the type of shop and number of purchase in them will affect the emotional fatigue of a consumer. Also, how to make shopping more attractive for different types of shops.

In this case, two Hypotheses can be assumed.

- Hypotheses 1

Different elements of the purchase process effect on the buyer identically [H_{11}] or heterogeneous [H_{12}]. Therefore, we suggest that any of this actions or things in purchase process could be a stimulus for consumer's emotional reaction [H_{11}]. Take need product, or understanding of chosen wrong one, waiting in line before cashier, a moment of purchase, the road to store, and back make an impact on the human state. Exploring of how human organism (semantic system, circulatory system, nervous system) react on purchase process elements in different shops gives an answer of fatigue level in them. Otherwise, the reaction for all participants will be the same on the element of the purchase process, or the absence of reactions could be also [H_{12}].

- Hypotheses 2

Buyer's emotional reaction is been identical in different shops [H_{22}] or its variable in each case [H_{22}]. We measured reaction or the absence of reaction to stimulus at whole purchase process in the current shop at the start and at the end of shopping. Different stores create various stimuli for the buyer. Buyer's reaction could be accumulated into fatigue. The differences on it could be assumed in different stages using pulse meter for fatigue measurements and GSR – for arousal emotions and fatigue.

3.2 Task, design, procedure

The participants were asked to go to the store and buy few things without a shopping list. There were no limitations (budget, time, etc.) for those purchases. Value of one purchase should not exceed 200 hryvnyas (8 USD), the average amount was 75 hryvnyas (3 USD). All shops were within or been within walking distance. Five consumers aged between 25 and 35 years were examined, and the research was conducted in the evening time period from 20.00 to 23.00 pm, which was by walking on 3 routes.

Actions of buyers differ greatly depend on the needs and goals of purchases, the nature of demand, motivations, and actions in the shop. We used the most well-known scheme of the consumer's decision-making process on buying a product of F. Kotler (Kotler & Keller, 2012). Its essence lies in the following 5 stages: after consumer's realizing any problem (I), which decision requires the purchase of certain goods, he or she starts to search information (II) about it, where the product can be bought and at what price. If there are a lot of alternative variants of the product, place of sale, and price, the consumer evaluates the information (III), selects the best variant for him or her, and makes a decision (IV) on the purchase. After the purchase, the customer goes back to home and final assessment is performed"(V).

GSR sensor was attached to the left hand on the index and ring fingers. NeuLog Pulse sensor was attached to the little finger of the left hand (Fig. 2).

Figure 2. Mounting sensors on the buyer and example of the photo and video fixation of the experiment

Overlaying of the video on the measurements of sensors made it possible to determine what the tested person felt at different moments of purchasing. This process was performed by hand. For the convenience, recording was started synchronously when the sensors start to work. Different types of shops such as kiosk and discounter were selected.

3.3 Characteristics of the measuring devices

GSR and heart rate were recorded by portable devices NeuLog GSR and NeuLog Pulse, respectively. The NeuLog GSR device can be used for any scientific experiment in which the GSR as a result of different incentives has to be measured.

It can be a picture, smell, sound, touch, and so on. The sensor comes precalibrated. Units of the GSR measured using Neulog GSR sensors are:

- Microsiemens: block of measuring of electrical conductivity,
- Analog arbitrary unit (arb): arbitrary unit, which allows demonstrating waves, frequency, and periods.

The device is self-powered, which provides high noise immunity and electrical safety measurements in different conditions; the main parameters are presented in Table 1.

Table 1. Features of the Neulog GSR sensor and NeuLog Pulse sensor

Parameter	µS	Arbitrary analog units (wave function)	Beats per minute	Arbitrary analogue units (wave function)
Range and operation modes	0–10	0–65,279 analog values	0–240	0–1023 analog values
ADC resolution	16 bit		10 bit	
Resolution	10 nS	1 arb	1	1
Max sample rate (S/s)	100		100	100

NeuLog Pulse device was used to measure the pulse. This sensor is used to monitor and compare the pulses of the person after different exercises and during rest. In addition, it shows the change in blood volume/flow in the fingers or ears in time (and helps to calculate the heart rate) or get the value of the heart rate directly through the software that comes with the device (Table 1).

3.4 Data processing

The degree of emotional stress is measured by determining the magnitude of indicators that objectively record physiological changes. The impact of elements of purchases process on the emotional state of the buyer (H_1) is analyzed by comparing the measurements at the start and the end of purchase element. To assess the shift of buyer emotional reaction (ΔE_i), the dependence was used (Prasolenko, et al., 2015):

$$\Delta E_i^{GSR} = \frac{(GSR_{i-1} - GSR_i)}{GSR_i} \cdot 100\%, \quad (1)$$

where GSR_{i-1} is the microsiemens value at the purchase process of the previous element (MSM) and GSR_i is the MSM value at the purchase process of the current MSM.

To assess the shift of buyer's emotional level for entire purchasing process (H_2), the value of the background level that was registered before going to a store in the calm state and in the actual emotional state at the end of the purchase process was measured using the formula

$$\Delta W_{0-i}^{GSR} = \frac{(GSR_0 - GSR_i)}{GSR_i} \cdot 100\%, \quad (2)$$

where GSR_0 is the microsiemens value before purchase process (Msm).

The more the current state (GSR_0) is deviating from the initial, the buyer become the more emotionally tired. Analysis of buyers' emotional reaction when visiting various shops can assess their attractiveness from an emotional point of view. When a buyer is less tired, he or she will possibly visit the store again.

To measure fatigue component (H_2), the Baevskiy stress index (1974) was used. It indicates the degree of adaptation of the cardiovascular system to the casual or permanent stimulus, and to assess the adequacy of processes of regulation, tension index of regulatory systems was used:

$$SI = \frac{Amo}{2Mo} \cdot MxDMn, \quad (3)$$

where M_o (mode) is the common values of R-R – rang, which corresponds to the most probable level of functioning of regulatory systems for a given period of time; Am_o is the amplitude of a mode, number of cardio intervals appropriate to M_o value (in %); MxDMn is the variation scope, the difference between the maximum and minimum R-R interval durations.

4 Data analysis and result

4.1 Conducted research results

The results of the conducted experiments are shown in Figs. 3–7.

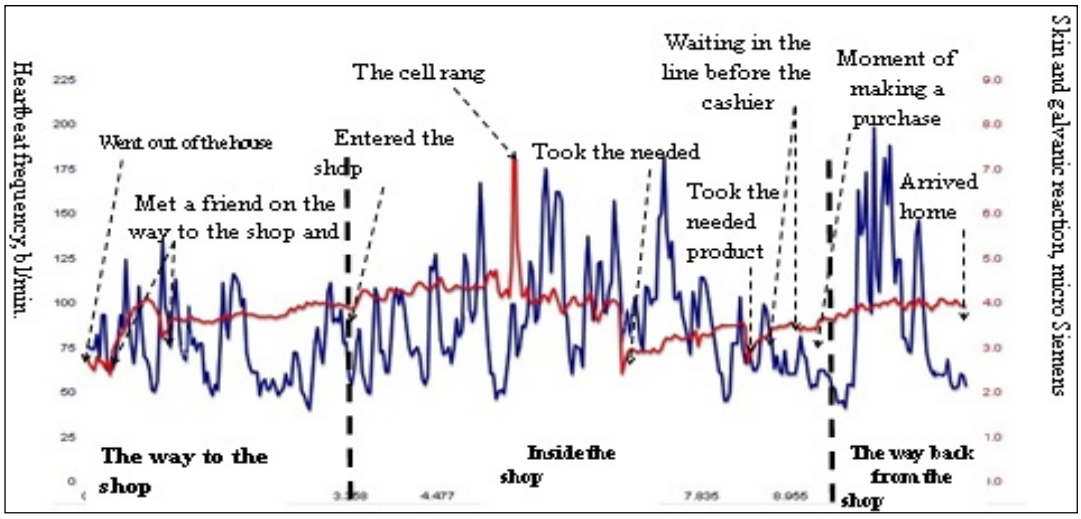

Figure 3. Measurement of the GSR (μS) and pulse (beats per minute) of a buyer during the visit of the shop that is located at 300 m from the buyer's home area. The area of the store is 450 m^2; the number of purchases made was 2.

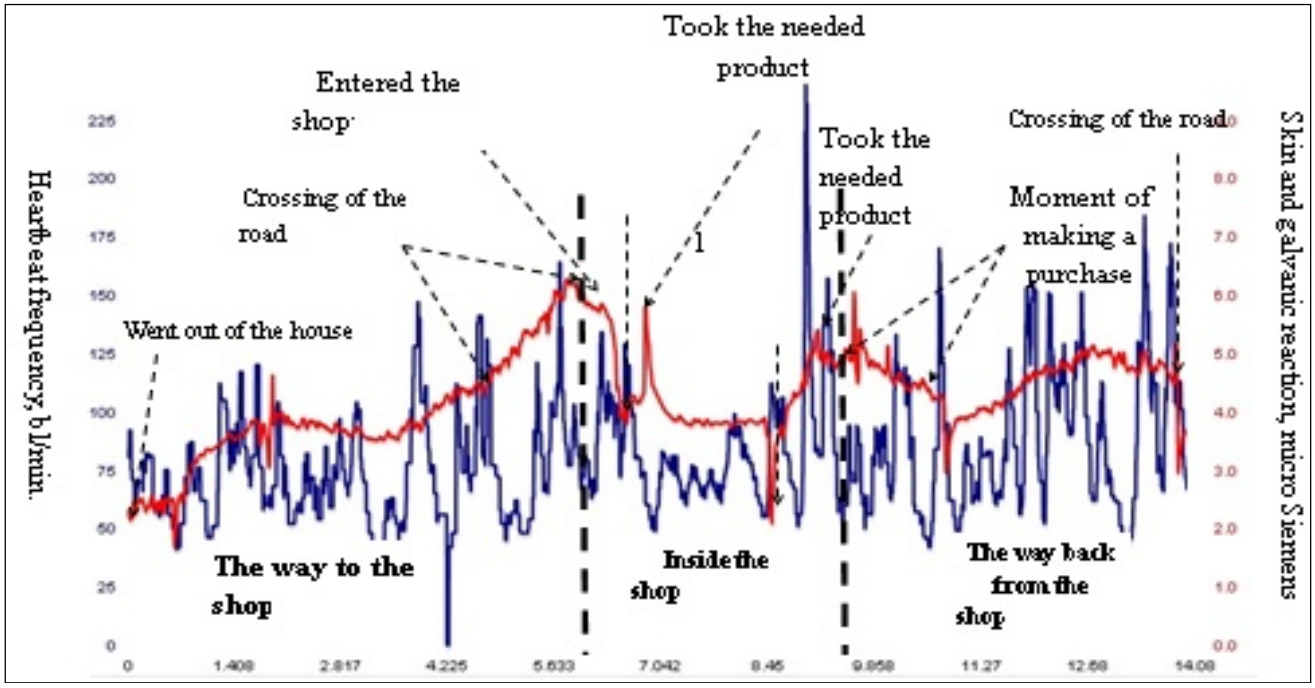

Figure 4. Measurement of the GSR (μS) and pulse (beats per minute) of a buyer during the visit of the shop that is located at 550 m from the buyer's home area.
The area of the store is 450 m^2; the number of purchases made was 1.

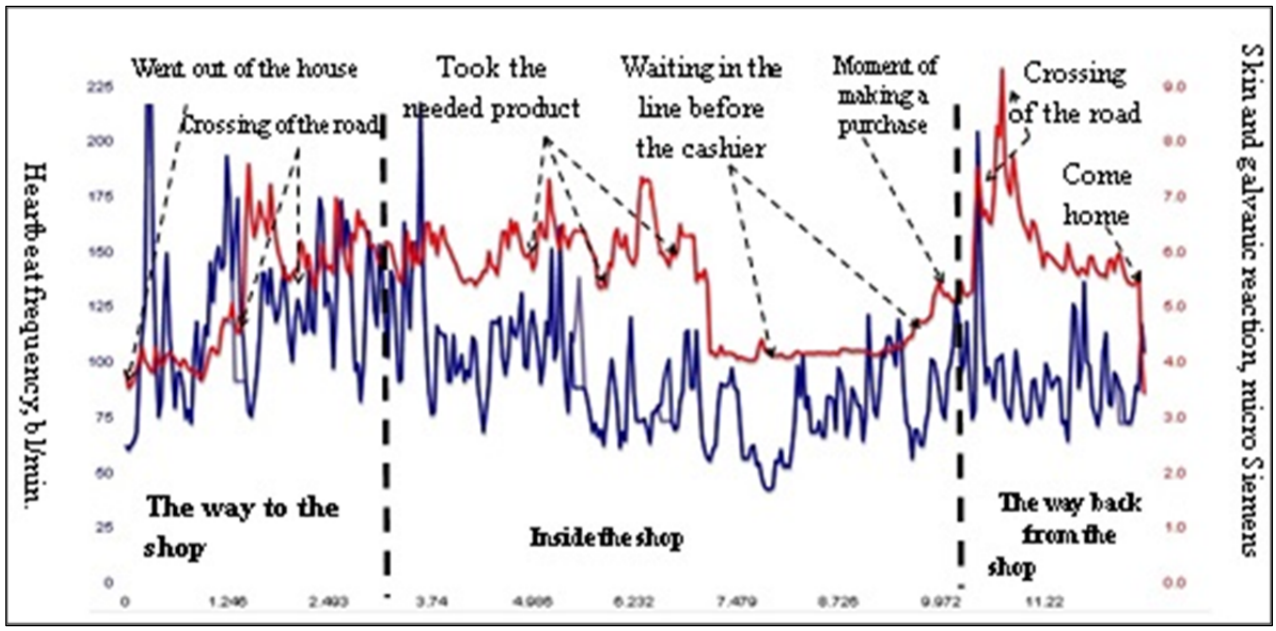

Figure 5. Measurement of the GSR (μS) and pulse (beats per minute) of a buyer during the visit of the shop that is located at 550 m from the buyer's home area.
The area of the store is 450 m2; the number of purchases made was 3.

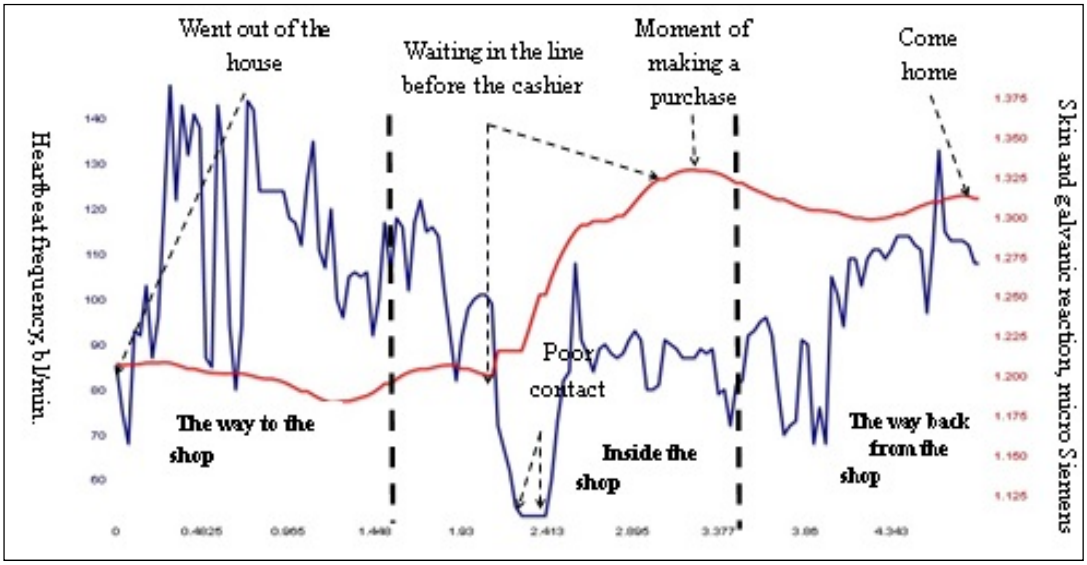

Figure 6. Change in the GSR (μS) and pulse (beats per minute) of a buyer during the visit of the shop that is located at 50 m from the buyer's home area. The area of the store is 20 m2; the number of purchases made was 1.

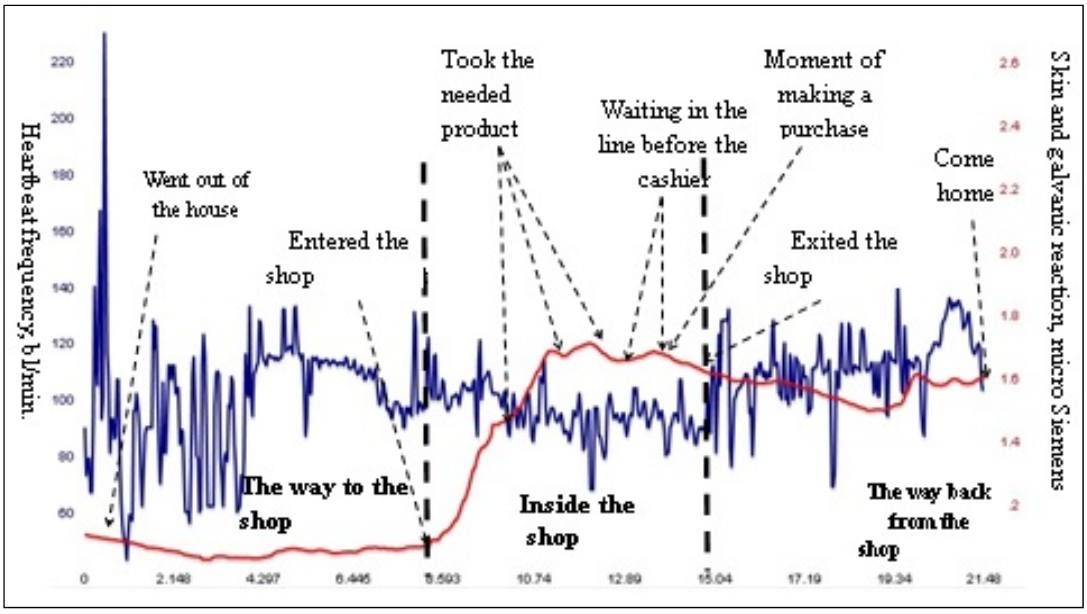

Figure 7. Change in the GSR (μS) and pulse (beats per minute) of a buyer during the visit of the shop that is located at a distance of 300 m from the buyer's home area. The area of the store is 450 m2; the number of purchases made was 3.

The results of "Neulog" measurements show that a buyer suffers less tension on his or her way to the shop than back way. The buyer's stress state increased while crossing the road.

4.2 Data processing

Visual analyses of Figs. 3–7 show that entering a shop, taking the needed product, and waiting in the line before cashier create an emotional reaction in a consumer. Such reaction can be conscious (took the necessary goods) and unconscious (realization of taken right or wrong product). It also confirms interconnection between environment and consumer's behavior.

One of the reasons for the wrong action is the deviation of the mental state of a buyer while visiting a shop. Strong positive or negative emotions can dramatically alter the physiological quality of a buyer, which eventually may lead to the fact that he or she will leave the shop without purchases.

The consumer receives information, processes it, and outputs in response to a certain stimulus and makes some action (e.g., take the needed product). Surplus or lack of information contributes to the development of fatigue, especially in trade service quality, when it leads to the saturation of a potential buyer with advertising, assortment, characteristics of various goods (Hunter, 2001).

According to Figs. 3, 5, and 7, waiting in the line for more than 2 min had virtually no impact on the buyer. Just before the cashier, a slight increase in the GSR is observed, which is caused by the fact that he or she is laying out the goods at the checkout.

At the same time, the data from Figure 6 indicate that even the short time of waiting in the line (1.5 min.) negatively affects the emotional state of the person: GSR increased sharply at 0.5 points; heart rate is also jumping.

Using eq. (1), the shift of the level of emotional intensity depending on different elements of purchase process was obtained (Fig. 8).

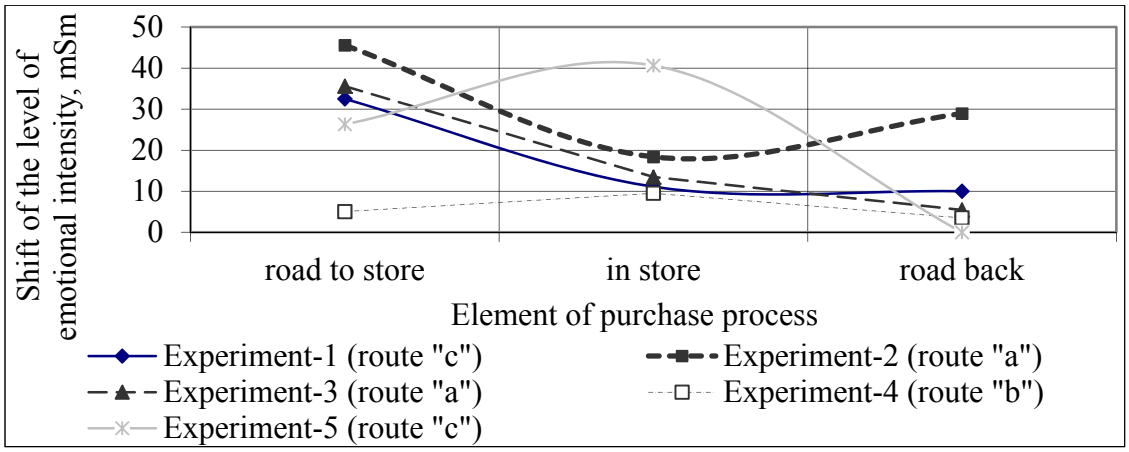

Figure 8. Shift of the level of emotional intensity on elements of the purchase process

Analysis of the results indicates the different effects of elements of purchase process on the human emotional state. Thus, the highest emotional shift is observed on "road to the store" and "in the store" elements and the lowest "on road back". There is a bigger shift in the level of emotional intensity in Experiments 4 and 5 in "shop" comparing with other elements of the purchase process. The shift of the level of emotional intensity on "road to shop" is higher than that on "road back home" in all experiments. Such reactions may be caused by the fact that all the buyers did not know what they will be buying in fact. These conclusions are made based on a conversation with the customers after experiments.

4.3 Emotional fatigue assessment

Along with the assessment of the buyers' emotional response, the value of ΔR-R Moda, amplitude of a mode, variation scope, and stress index (3) was assessed. The results and the input data obtained from the experiments are presented in Table 2.

Table 2. Results of the biological activity of consumer

Experiments	M_o (BPM)	M_o (ms)	Am_o (%)	ΔR-R, BPM	ΔR-R, ms	SI
Results of the biological activity of consumer while walking to the store						
1	99.3	604.2	27.1	98	612.2	36.6
2	104.3	575.3	19.2	125	480.0	34.8
3	143	419.6	21.7	165	363.6	71.1
4	120	500.0	16.2	73	821.9	19.7
5	115	521.7	22.4	205	292.7	73.3
Results of the biological activity of consumer inside of the store						
1	101	594.1	20.5	145	413.8	41.7
2	79.3	756.6	19.9	175	342.9	38.4
3	101.5	591.1	34.3	158	379.7	76.4
4	87.4	686.5	36.7	54	1111.1	23.9
5	107.4	558.7	66.5	59	1016.9	58.5
Results of the biological activity of consumer on the way back to home from the store						
1	121.2	495.0	12.5	150	400.0	31.6
2	99.6	602.4	15.8	144	416.7	31.5
3	119.2	503.4	31.9	133	451.1	70.2
4	115.4	519.9	15.2	66	909.1	16.1
5	109.4	548.4	43.7	78	769.2	51.8

Normal values of Am_o fluctuate in the range of 30–50% (Baevsky, 1997). If this indicator is higher than 50%, this shows the lack of variability in the heart cycle, which demonstrates a lack of capacity for adaptability. If the value is lower than 30%, it indicates low stimulus reaction and hinders the information perception. The second condition we see in almost all experiments except in third and fifth experiments but only in the period of visiting the store and after. This indicates some activation in store.

A healthy heart would have a wide range of variability (a wider variation in the spaces in between heartbeats) that demonstrated the capacity to adapt to changing conditions within the body. Reduction in the variability demonstrates a lack of adaptability and so a wider base would indicate a higher level of adaptive capacity (for healthy adults at relax state, it is 0.15–0.30 s). A narrower base indicates a higher level of stress (Baevsky, 1997), which is observed in Experiment 5.

The buyer‘s body, at the time of exit from the house, did not receive significant changes according to researched indicators. But, in the store, it can be observed that the amplitude of a mode and heart rate were decreased and “SI” indicator was increased. As shown in Table 2, almost all explored performances get out of variation norm at the shop at any experiments. “On the way back” to home indicators return to normal state, but “SI” is higher than “on the way to store”. All these changes are statistically significant and indicate that shopping process causes fatigue reaction that cumulated throughout the shopping trip.

The essential heart rates are between 100 and 120 bpm and 60 and 90 bpm in relax state. Variation in heart rate measured at any given time period represents that the system affects the parasympathetic nerves, which slows indicator (Experiment 2, “into road to shop” element), and the sympathetic nerves, which accelerates it (Experiment 3).

The smaller the “SI” value, the greater is the activity of sympathetic division and higher cardiac cycle centralized degree (Baevsky, 1997). The raise in “SI” in the store shows the increase in stressed regulatory systems (Experiments 1–4), caused by the psychoemotional load of different stimuli: lights, assortment, different products and conflicting data fields between them, and so on.

Reactions to these stimuli increases the influence of the higher parts of the vegetative nervous system and indicates about rising of buyer’s fatigue level. The exception is the fifth experiment; the high level of “SI” activity “on road to store” is explained by crossing the road in heavy traffic condition nearby to a traffic accident (Fig. 9).

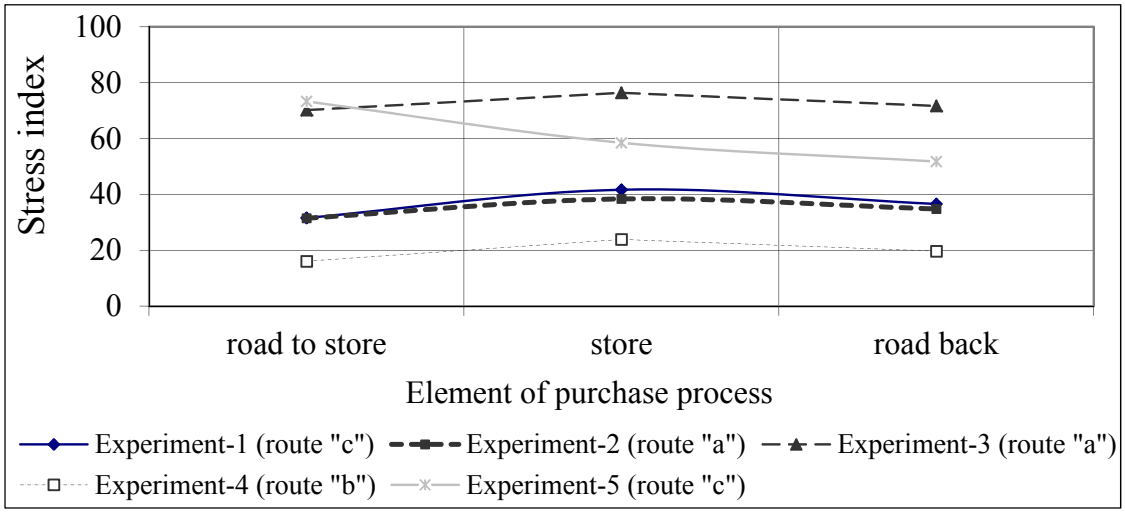

Figure 9. Stress index dependence on the elements of the purchase process

The reaction to stimuli in quite a long shopping leads to the depletion of functional reserves of the body, causing a state of emotional fatigue, which has been indicated by the growth of all the characteristics when compared with the initial state (Fig. 9). Lingering purchases in Experiments 3 and 5 affect the buyer's emotional fatigue and stress index greater than that in other shops. Therefore, it can be assumed that fatigue is a function of time. Consequently, the buyer’s background emotional fatigue appears and progresses during purchase process (H_2) in any case differently. But, as can be seen from Fig. 9, small stores (kiosk; Experiment 4) become always less fatigue than a big one (discounter). It confirms that a buyer can avoid bigger shops with less emotional fatigue, even if he/she will spend much money in this case. The results have shown that equal level of fatigue can be found at various shops, depending on the visiting time and number of purchase items.

5 Discussion

Existing methods really researched a buyer’s reaction to different elements of the purchasing process

and could not assess the emotional state in different stores. Existing studies get the results of experiments in a "pure" form when the environmental factors that influence the tested person are reduced to a minimum. Application of the method allows assessing the environment at each stage. Influence of each stage on a buyer varies [H_{12}]. Any actions (take need product, or understanding of chosen wrong one, waiting in line before cashier, a moment of purchase, the road to store and back) in the purchase process is been a stimulus for consumer's emotional reaction. Continuos buyer's reaction to stimuli in purchase process rises his or her fatigue level, and the buyer's emotional reaction level is been variable [H_{22}] in each case.

The overall tendency to fatigue accumulation during the whole purchase process was evaluated. The stress index is rising inside of the shops and decreases on the road back, but the overall state is been higher than at home situation.

6 Conclusion

The results improve assessing the quality of trade services by creating conditions conducive to a more favorable environment for stores. The presented method estimates the buyer's emotional fatigue level while visiting any shop and allows to compare results with other rivals.

Previously, the one-purchase attempt for visiting two different shops on the one buyer's trip was described (Halkin, 2016). A conceptual framework for assessing buyer's emotional state for evaluating results for different stores was presented. Evaluating the performance of the emotional reaction of buyers on different types of stores allows to process the data and compare the human reaction according to stress index. Therefore, the regularities of buyer's reaction on the current store could be predicted with some level of assumptions and limitations. The obtained data can be also used in MCM (McFadden, 1974) or CDM (Foteringham, 1983) models to describe demand distribution by considering the human factor.

Future research should verify whether the proposed method can effectively evaluate buyer's reactions to the purchase process. It is also necessary to develop a benchmark for the evaluation of different people with different parameters in different stores. Such studies would help to evaluate patterns of human response during any purchase process.

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