

Article

Not peer-reviewed version

---

# Identification of Factors Influencing Customer Emotions in Online Shopping of Luxury Cosmetics

---

[Milad Zam](#)\*, Amin rezasoltan, Hasan Ramezani, Mohammadhosein Tavakoli

Posted Date: 14 February 2023

doi: 10.20944/preprints202302.0232.v1

Keywords: customer emotions; cosmetic products; luxury products; online shopping



Preprints.org is a free multidiscipline platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## Article

# Identification of Factors Influencing Customer Emotions in Online Shopping of Luxury Cosmetics

Milad Zam <sup>1</sup> , Amin Rezasoltani <sup>2</sup>, Hasan Ramezani <sup>3</sup> and Mohammadhosein Tavakoli <sup>4</sup>

<sup>1</sup> Faculty of Management, University of Tehran, Tehran, Iran; m.zam@ut.ac.ir

<sup>2</sup> Ava and Nima Social Robotics Co. (Dr. Robot), Tehran, Iran; Aminrezasoltani123@gmail.com

<sup>3</sup> Department of Mechanical Engineering, Amirkabir University of Technology, Tehran, Iran; h\_ramezani@yahoo.com

<sup>4</sup> ESADE Business School, Ramon Llull University, Barcelona, Sant Cugat, Spain; mohammadhosein.tavakoli@alumni.esade.edu

**Abstract:** Most buying decisions are affected by the customer's analysis of the advantages and disadvantages of the product and its emotional aspects. Psychological and marketing studies have confirmed the role of customer emotions in various stages of the purchasing process. The present study aims to identify the dimensions and factors that potentially influence customer emotions in buying luxury cosmetics. First, in order to identify the various aspects of customer emotions, a qualitative study was conducted using in-depth semi-structured interviews with 23 customers of luxury cosmetics and health products in Telegram groups. This study led to the identification of various dimensions of customer emotions and a list of factors that potentially act as antecedents of emotions in the target population. In the next step, based on group consensus, the antecedents affecting customer emotions were determined. The members of the panel at this stage included 15 specialists and experts in the fields of marketing, psychology, companies importing luxury cosmetics and hygiene products which are active in online networks, as well as managers of luxury cosmetics and hygiene groups in online spaces. The consensus of experts was reached in three stages and 36 factors affecting customers' emotions were determined and ranked based on the relevance or strength of the perceived effect from the point of view of experts. Finally, they were classified into three categories as group and product variables, situational variables, and individual variables.

**Keywords:** customer emotions; cosmetic products; luxury products; online shopping

## 1. Introduction

A global consumption pattern, which is also rapidly expanding in Iran, is the passion for luxury goods, including luxury cosmetics and hygiene products. This is most popular among the younger generation of society [1]. The promotion of global luxury brands in Iran, such as cosmetics from MAC, Clinique, Chanel, Kiehl's, Lancôme, Dior, Morph, and Toofaced are examples of this phenomenon. In recent years, with the increase in the number of smartphone internet users and virtual networks, including Telegram and Instagram, the attention of many manufacturers and sellers has been drawn to this area as a product supply channel. The beauty and luxury of the products could cause internal motivation and an intention to buy, and this passion is a type of emotion that appears instantly. In addition, considering the young population of Iran, which consists of 45 % of the total population according to statistics of the Iranian Statistics Center, (35.7 million people in the age group of 20 to 44 years) (Iran Statistics Center 2019), this phenomenon becomes more evident. The role of customer emotions is evident in the purchase of luxury goods and emotions have a large role in the formation of consumer experience and influence people's consumption reactions. Consumption emotions are kind of the emotional reactions experienced before and during the consumption of a product [2]. Today's consumers establish an emotional relationship with the product and brand and based thereupon, he/she decides to choose and buy [3–5]. Therefore, being aware of the role of customer emotions can be very important for product marketing [6]. In addition, identifying all variables that excite

customers in a market and which lead to the purchase process is specific to that market, which may be caused by factors such as the variety and options of products, prices, shopping environment, and other factors mentioned previously. Therefore, in each market, these and other factors that have not yet been identified should be investigated based on the environmental, cultural, technological, and other characteristics of that market. As mentioned in foreign studies, the factors affecting the emotions of customers, especially in online shopping, are not comprehensively measured, and most of the research has been conducted in offline stores, for example, [7–9]. In this study, an attempt is made to investigate the factors affecting emotions in an online environment from the perspective of customers as well as from the perspective of experts by using comprehensive views. In addition, considering that the previous foreign studies were conducted in the western cultural context, their results cannot be generalized to all markets, especially the cosmetics market in Iran. Therefore, more generalizable results can be created by considering cultures different from the western ones. Conducting comprehensive research in the Iranian market, considering the different values of consumers for choosing products, as well as the clear difference between luxury cosmetic brands and those available in Iran, which have been examined in the studies conducted in the dimension of creating excitement and the factors affecting it for customers can fill the existing gaps and the current study also seeks to achieve such goals.

## 2. Background

### 2.1. *The Theoretical Background of the Study*

#### 2.1.1. Customer Emotion

Emotion expression is another form of discourse that is universally treated and understood. Emotions must be considered as a distinctive element to enrich the product or service offered [10]. Emotions refer to the evaluation of customer feelings about the experience of a company brand, product, or service [11]. Emotion is an attitude that can stimulate, organize and guide people's perceptions, thoughts and behaviors. Emotions affect all aspects of consumption from pre-purchase decisions to post-consumption behaviors [10]. Researchers distinguish between general emotions and consumption-specific emotions. Unlike general emotions, consumption-specific emotions especially occur during the use of a product or maybe evoked and be considered as effective responses. Emotions are short and sharp waves of feeling that occur without conscious effort and are usually accompanied by increased activation of the autonomic nervous system, and physiological changes in heart rate and breathing [12]. Many authors admit that there are positive and negative effects in the experience of emotions, all people have either positive or negative emotions. [13] suggested that people's emotional indicators include 62 emotional states. [14] believes that a person can express his emotions with his facial expressions and may present ten basic emotions including interest, pleasure, surprise, sadness, anger, disgust, contempt, fear, shame, and guilt. [13] identified eight main emotions, including fear, anger, joy, sadness, acceptance, self-disgust, anticipation, and surprise. In his study, [15] considered negative emotions, which included fear, anger, shame, discomfort, and disappointment. [16], considered the dimensions of customer emotions including excitement, enthusiasm, fun, happiness, interest, excitement, and inspiration. [17] showed emotions with the components of anger, comfort, pleasure, fear, happiness, importance, confusion, pride, specialness and distinctiveness, sadness, shame, and complexity. [9] classified emotions into two categories: positive and negative. Positive emotions, in their opinion, included pleasure, excitement, and relaxation and negative emotions included anger, distress, hatred, and fear. [18] divided emotions into two categories of positive emotions (excitement and happiness) and negative emotions (anger, anxiety, and depression). In their study, [19] only considered positive emotions and considered them to include comfort, happiness, satisfaction, and romanticism. [20] also divided the customer's emotions into two categories positive (joy, pride, fun and entertainment, interest and attachment) and negative

(anger, hatred, humiliation, disgust, enmity, and fear). [21], in their model, considered satisfaction, happiness, peace, optimism, pleasure, and excitement as dimensions of positive emotions, and anger, fear, discomfort, and embarrassment as dimensions of negative emotions. [22] took into account positive emotions such as excitement, surprise, peace, and pleasure, and negative emotions such as anger, disgust, and hatred, shame, distress, and despair.

### 2.1.2. Factors Affecting Customer Emotion in Purchasing

Many studies have been conducted on emotional purchasing that try to identify variables that facilitate the emotional purchase. The variables affecting emotional buying can be classified into four groups: individual variables, those related to the product, environmental and situational variables, and variables related to the person which affect the tendency to make emotional purchases. The higher the emotional buying tendency of the consumer, the higher the probability of emotional buying [23]. Product-related variables are relevant to products that are bought emotionally. Emotional buying modes are different based on product and product categories. Variables related to the shopping environment are the store space, special displays, shelf signs, and tempting graphic advertisements or sales promotions. Also, media formats to provide information in the online shopping environment could affect emotional shopping behavior. Situational variables are also related to money and time available for purchase and the availability of credit [24]. Various studies have confirmed the effect of different variables on the emotions of buying different products and services, in order to provide a comprehensive picture of the factors which affect emotions and emotional buying of customers. They can be divided into a variables in general categories which are described below.

#### Individual Variables

**Demographic information (age, gender, income level, etc.)** is used as independent variables. There are different theories about whether the income and age of consumers have significant positive effects on online shopping [25]. Previous studies have shown that in general, young people are more willing for emotional purchases than older people [24]. The difference between men and women also affects decision-making priorities. In some studies, it was found that men shop online more than women do [25]. Income is also highly related to emotional buying behaviors. People with low household incomes mostly use buying lists [24]. Personality traits can be defined as a set of thoughts, attitudes, behaviors, perceptions, activities, and other different characteristics of a person. Personality could be defined as features, appearance, and variables of human beings. Emotional shopping is considered an emotional aspect of personality that enables a person to take quick actions without deep thought or consideration of alternative costs. To understand the role of personality in creating purchase motivation, the five-factor personality model is used, which includes the components of openness, extroversion, agreeableness, conscientiousness, and neuroticism, which include all the characteristics of human personality [26].

**Variety-seeking:** Some researchers stated that buyers are looking for varieties and options, which may be the main reason for switching the brand and also their emotional purchases. Also, variety-seeking behaviors are related to emotional buying [27].

**Hedonism:** The pleasure of shopping means the pleasure that person gains in the buying process [28]. People who enjoy shopping are called recreational buyers, and they spend more time shopping and shopping more often [29].

#### Situational Variables

**Available time:** Customers who have more time to shop tend to buy more goods than what they have planned for. Therefore, if a customer feels good in a store, he may spend more time there, and as a result, the probability of making unnecessary purchases increases [25]. On the contrary, consumers

may change their shopping habits or shop selection when they lack time. But customers who have enough time to shop have less pressure in choosing products and, therefore, pay more visual attention to the store environment, which can create more calm and positive emotions during shopping [29].

**Available money:** It refers to the amount of money or extra funds that people have or spend in a day. In addition, available money is an important factor in stimulating people's purchasing decisions. Available money is a source of purchasing power. If the customer has more money, s/he can change his planned purchase pattern and this increases his/her purchasing power [25].

**Economic well-being:** It refers to the economic health of the person. This concept is different from the variable of "money available" in the bank account. When measuring this variable, a person's overall financial situation is considered as a long-term perspective. It is thought that those who score high on the scale of economic well-being are more likely to make emotional purchases [25].

**Experience:** The experience of using a website or social media is known to be one of the important factors in e-commerce. The online shopping experience, which is commonly used as a situational factor variable construct, is related to the user-friendliness and enjoyment of online shopping [30].



## Product and Environmental Variables

**Presence of friends and peers in the environment:** Based on the assumption that friends and relatives may strengthen the buyer's purchase decision and as a result, more purchases occur, stores that attract couples, friends, or groups are usually better off in terms of performance. The presence of peers increases the desire to buy and the presence of family members reduces it [25] **The atmosphere of the shop:** The atmosphere of the shop includes the arrangement of goods, lighting, and the use of colors. It can significantly affect the emotions and buying behavior of consumers and may lead to emotional shopping and the intensification of emotional shopping behavior [25]

**Luxury and up-to-dateness of products:** The purchase of special emotional products is the result of the engagement with the product and the buyer's desire for emotional buying. Emotional purchase based upon the current fashion is stimulated by new fashion styles and brands that lead consumers to emotional purchases [29]

**Advertising activities and marketing stimuli:** Sales promotion is carried out to stimulate customer demands and encourage consumers to make an emotional purchase of a particular brand. An effective and planned advertisement can also stimulate the intention of consumers to buy when products are offered at a discount. Consumers are more inclined to make emotional purchases [25].

**Friendly relations of the employees:** The presence of a well-behaved salesperson in the store can be a special service for customers. Praising customer while shopping by the salesperson may increase the chances of an emotional purchase, and professional employees can also reduce consumers' regret of purchase by supporting them during the buying process [25].

**Product specifications:** Some goods are bought more emotionally than others, which depends on their category, price, and the symbolic meaning of the goods. Also, emotional purchase is more likely to occur for products with lower prices or a shorter production cycle [31]

**Customer engagement with the product** Customer engagement with the product and brand is a motivational state of interest that is triggered by a specific stimulus or situation. In general, engagement is conceptualized as an interaction between a person (consumer) and an object (product). Product engagement may be different between emotional shopping and regular, planned shopping [29]

## 2.2. Experimental Background of the Study

In this section, some domestic and foreign studies related to research variables are reviewed. [32] carried out a study entitled "Investigating the effect of online store features on impulse buying behavior resulting from customer emotions". The findings of the study indicated that the environmental characteristics of virtual stores (store content, store design, and store navigation) have a positive and significant effect on online impulse buying behavior. Also, the mediating role of customer emotions on the relationship between the environmental characteristics of the virtual store and impulse buying behavior was confirmed. [33] performed a study entitled "Investigation of factors influencing the intention to buy online in Iran: a study of the fashion and clothing markets". His results indicated that innovativeness, perceived security, quality of information, and trust in the fashion industry has a positive and significant effect on the intention to buy online. Also, cost-effectiveness and timeliness have a positive and significant effect on the perceived value of online fashion shopping. In addition, perceived value has a positive and significant effect on online shopping intention. [34] performed another study entitled "identification of the building blocks (value offered to the customer) and their effects on customer satisfaction using sentiment analysis based on text mining". The results showed that the analysis of customer opinions and the content generated by users to examine customers' attitudes about the product is a practical method and an effective tool for businesses to present a successful product with features approved by the consumers. [35] conducted a study entitled "Investigation of the effect of emotion on the customer's purchase intention with the mediating role of customer engagement." The study aimed at investigating the effect of emotion on customer purchase

intention with the mediating role of customer engagement and brand image. The results of the data analysis showed that emotion has an effect on customer involvement, emotion has an effect on brand image, involvement (engagement) has an effect on brand image, and brand image has an effect on purchase intention. [36] conducted a study entitled "Investigating factors affecting online shopping and sales promotions on the emotional buying behavior of customers". Data analysis showed that online shopping and sales promotion tools have an effect on customer behavior and gender has a significant relationship with emotional shopping. [7] conducted research entitled "Individual and in-store factors influencing emotional buying behavior among consumers in small cities". The results showed that individual (personal) factors, including available time and family influence, had a positive and interesting effect on emotional purchase behavior. In-store factors also had an interesting impact on impulse buying behavior. But the effect of available money on impulse buying behavior was not confirmed. [21] conducted a study entitled "The effects of positive and negative emotions in online shopping on consumer satisfaction, repurchase intention, and recommendation intention". The results showed that positive emotions have stronger effects compared to negative ones. [26] conducted a study entitled "The influence of personality on emotional shopping behavior in developed countries". The results showed openness, extroversion, conscientiousness, and neuroticism have intensive effects and pleasantness has little effect on emotional buying behavior. [8] conducted a study entitled "Investigation of the influencing factors on emotional buying behavior". The results of the study showed that available money has a direct effect on emotional buying behavior. Also, the effect of available money became significant indirectly through the mediating variable of the purchase idea. [16] conducted a study entitled "The Moderating Role of Situational Factors (Available Money and Time) on Emotional Behavior". This study showed the direct effects of the characteristics of the environment on the positive emotional responses of the customers and the direct effects of the positive emotional responses of the consumers to the retail environment on emotional buying behavior.

### 3. Research Method

To achieve the objective of the study, that is, to identify the dimensions of the customers' emotions and to investigate, prioritize and categorize the antecedents affecting the emotions of customers when buying luxury cosmetic products, a two-stage method (qualitative-quantitative) was used, which included thematic analysis and the fuzzy Delphi method. The purpose of the thematic analysis was to identify the dimensions of customer emotions through the real experiences of customers who had a history of attending and buying a lot of luxury cosmetics in online shopping groups. On the other hand, the fuzzy Delphi method was used with the consensus of experts to investigate the potential antecedents affecting customers' emotions. Then, the identified antecedents were prioritized and categorized based on their significance.

#### 3.1. Thematic Analysis

In the first step, an in-depth semi-structured interview was used to collect the required primary qualitative data. For this purpose, several active and experienced customers who have made a lot of purchases from online cosmetics-selling Telegram groups were selected (based on the repetition of their IDs in the group lists). Considering the qualitative nature of the study, sampling was performed by a judgmental or purposive method, and the sample size was determined based on theoretical saturation. Accordingly, in the end, the first sample included 23 subjects, which reached saturation with this number of interviews. The interview forms included two main parts. In the first part, the respondents were asked about their demographic characteristics and required information about their use of virtual networks (in terms of hours per day) and the time they spent in online groups buying cosmetics. The second part was designed to obtain the dimensions of the respondents' emotions as well as the factors affecting them during the stages of being in the group and the buying process. They were asked to explain their emotions such as anger, worry, happiness and fear when they enter a telegram group for selling cosmetics online and see the products, read the comments, discuss with

members and compare the prices. They answered by describing their mental state. The responses were fully recorded by an audio recorder to ensure that no important points were missed. Then, to analyze the data obtained from the interview, the data-based inductive theme analysis was used to identify, analyze and report patterns or themes in qualitative data. In this method, the researcher can report the obvious meanings of the data as well as the hidden meanings and assumptions, and ideas of words, phrases, and sentences [37]. Next, the guidelines of three professors and experts in the field of marketing and theoretical validity were used in the study of existing theoretical foundations for the interpretation of themes and the output of data analysis. To measure the reliability of the data in the interview stage, the ICR method and the "Holsti method" were used. In the present study, coding was performed first by the researcher and then by an expert, and then its reliability was calculated. The obtained reliability for the dimensions of customer emotions was equal to 87 %, which indicates the appropriate reliability of the research data.

### 3.2. Fuzzy Delphi Method

According to the purpose of the study, i.e. to identify the factors affecting the emotions of customers in purchasing, a group decision-making approach [38–45] was used, which aims to provide predictions by reaching a group consensus by a group of qualified experts [46]. This method is very important, especially in qualitative studies [47–54]. Panel members in the Delphi technique were selected by researchers based on defined standards. In this technique, the main emphasis is on the selection of panel members rather than their numbers. They should be knowledgeable and have expertise and experience [55]. In this study, a panel consisting of 15 experts in psychological marketing of luxury cosmetics-importing companies active in virtual networks and active managers of Telegram groups related to luxury cosmetic products were used.

## 4. Results

### 4.1. Results of the Content Analysis

As mentioned in Sections 1–3, the first step was to interview real customers to identify their perspectives. The interviews provided three main categories of information: (1) Demographic information, duration of use of virtual networks in terms of hours per day, and the time they spent buying cosmetics and hygiene products in online groups; (2) dimensions of customers' emotions and (3) possible antecedents of customers' emotions. For content analysis, the contents of all the interviews were transcribed and the resulting content was read several times to determine the general pattern in the text of the interviews. Then, based on the patterns observed in the general framework of the interviews, a list of primary codes was created. In this step, a total of 454 codes were first identified. In the next step, these codes are categorized into groups with similar and coherent concepts in the form of 33 codes. Table 1 shows the findings of the first step, which includes the concepts which are most relevant to the purpose of the study and the number of times that each concept was repeated in the interviews. The output of this step includes 11 secondary themes that led to 2 organizing themes of "positive emotion and negative emotion" based on the overarching theme of customer emotions.



Table 1. Seeking and identification of codes and themes.

Comprehensive theme	Organizing theme	Secondary theme	Basic codes
Customer emotions	Positive emotions (191)	Pleasure and joy (84)	Happiness, joy of being in a group and the possibility of buying (33)
			Happy to be in the group and feel good about it (16)
			The pleasure of interacting in a group (14)
			Hope in supply and buying the product from the group and hoping for the product's effectiveness (21)
		Excitement and arousal (55)	High excitement and arousal in the cosmetic group (27)
			Becoming emotional due to being in the cosmetic group and emotional shopping (19)
			Getting emotional and standing on ceremony to buy (9)
		Love and emotionality (15)	Interest in/ passion for members and cosmetic products (15)
		Easy and reliable (18)	Peace of mind and confidence in the shopping group (18)
		Positive surprise (19)	Being surprised by the variety of prices and effects of products (19)
	Negative emotions (263)	Sadness (50)	Boredom and getting bored of the group (11)
			Feeling of misery due to comparison of prices and inability to buy the desired product (8)
			Annoyance and resentment from admin and members (6)
			Being sad in the group due to the price comparisons, behaviors, sold out products, cancellations, etc. (13)
			Depression due to the dollar rate, depression from buying / not buying the product (8)
			Buying / not buying because of loneliness (4)
		Fear (72)	Confusion in choosing, listing and buying products (14)
			Feeling worried and lost (23)
			Being nervous and annoyed by the volume of group conversations and wandering in groups (10)
			Anxiety and stress from listing and ordering to delivery of the product (16)
			Concern when choosing a product and the suitability of the purchased product (9)
		Regret, feeling inferior (69)	Regret from buying or not buying (17)
			Regret and envy for not having the product with the inability to buy it (16)
			Regret from buying too much (17)
			Guilt from giving wrong advice to members and a large and repeated volume of purchases (8)
			Feeling humiliated against others (4)
			Embarrassment in the group (7)
		Anger (48)	Getting angry with the admin and group members (13)
			Annoyance and resentment of the atmosphere that dominates the group and the people of the group (12)
			Hatred of people and shopping groups (4)
		Jealousy (6)	Complaining about admin and members, dissatisfaction and bad feeling about ordering and buying products (19)
			Jealousy of other people's purchases (6)
		Disappointment (18)	Feeling of despair (18)

In the next step, based on the output of the previous step, the theme diagram of customer emotion dimensions is drawn. The theme diagram is drawn as a website network, showing the theme levels along with the relationships between them. Figure1 shows the theme diagram of the study.

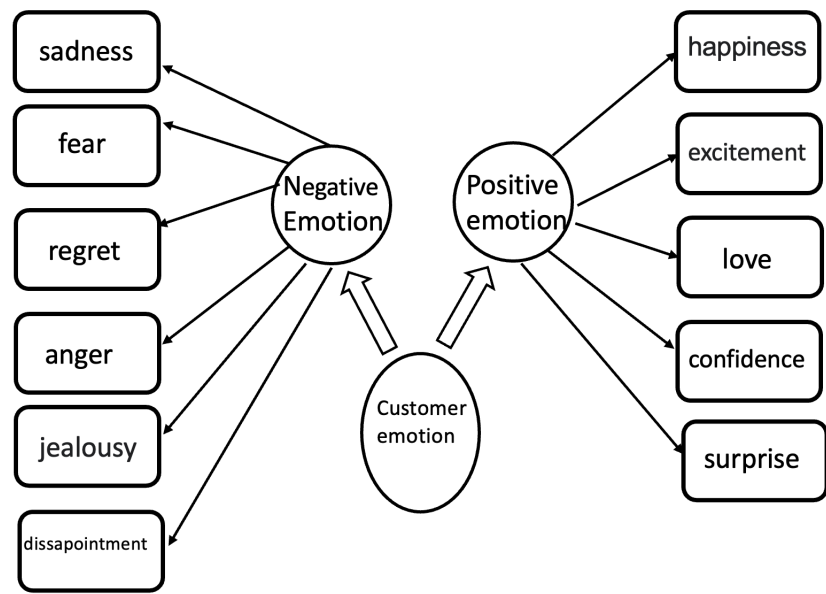


Figure 1. Theme diagram of dimensions of customers’ emotions in the process of buying luxury cosmetics and health products in Telegram groups.

#### 4.2. Fuzzy Delphi Method

**First step:** As mentioned earlier, interviews with active customers led to the identification of effective factors as antecedents of emotions of online shopping from the customers' point of view. These factors, along with those in previous studies on emotions, formed the primary basis for the implementation of the Delphi method. Table 2 shows the effective factors of customer emotions.

**Second step:** First, a semi-structured interview, consisting of 3 parts, was conducted: A. Items related to the demographic characteristics of the experts to obtain a comprehensive view of the panel; B. 36 items to obtain experts' assessment of the potential impact of each factor on the subject under study according to Table 2 (factors obtained from library studies and qualitative interviews based on a five-point Likert scale from "very much" to "very little"; C. Finally, they were asked a general question: "In addition to the above, mention any other factors you know that influence the emotions of customers in the process of buying cosmetics and health products and specify the effect of that factor". Then, through e-mail or face-to-face meeting, this semi-structured questionnaire was sent to the 15 members of the selected panel in the field of psychological marketing, active managers of luxury cosmetics telegram groups and luxury cosmetics-importing companies in Bandar Abbas which are active in online selling as well as active managers of Telegram groups of luxury cosmetic products.

**Table 2.** Factors affecting online shopping emotions based on interviews and available resources.

Row	Studied variable	Row	Studied variable
1	Available time	19	Browsing groups
2	Available money	20	Enjoyment of shopping
3	Product Specifications	21	Method of presenting items and product photos
4	Shopping style	22	Listing and pricing in the group
5	Experience	23	Price is more suitable than the store and online shops
6	Internet usage time	24	Group promotional activities and marketing drivers
7	Age	25	The atmosphere of the group
8	Gender	26	Number of group members
9	Income level	27	Presence of friends and peers in groups
10	Level of education	28	Shopping channel (providing invoices and showing other people's purchases)
11	Friendly relations of admin of the group	29	Convenience and the possibility of buying all brands
12	Psychological characteristics of the consumer	30	Reliability and quality of the group
13	Economic prosperity	31	Customer curiosity
14	Brand image	32	Desire to experience new products
15	Level of customer engagement with the product and brand	33	Group buying versus individual group buying
16	Luxury and up-to-date products	34	Reading reviews and get feedback from the product and use it
17	Diversity-seeking	35	Individual interactions in the group
18	Family influence	36	Culture and cultural factors

**Third step: Data analysis a.** The third step was to analyze the answers of the panel members and the fuzzy Delphi method was used to obtain the consensus of the experts' opinions. Accordingly, to convert the qualitative analysis into fuzzy numbers, the definition of trapezoidal numbers was used as a corresponding conversion scale.

b. After converting the qualitative values provided by the panel members into trapezoidal fuzzy numbers, the fuzzy geometric mean of each component was calculated using Equations (1) and (2) [46].

$$A_j^i = (a_1^i, a_2^i, a_3^i, a_4^i) \quad i = 1, 2, 3, \dots, n$$

$$j = 1, 2, 3, \dots, m \quad (1)$$

$A_j$  represents the  $i^{th}$  expert's opinion about the  $j^{th}$  factor.

**Table 3.** Trapezoidal fuzzy numbers corresponding to the qualitative values.

Trapezoidal fuzzy numbers	Value
(7,8,9,9)	Very much
(5,6,7,8)	Much
(3,4,5,6)	Average
(2,3,3,4)	Little
(0,0,1,2)	Very little

$$A_{j\ avg} = (a_{j\ avg\ 1}^i, a_{j\ avg\ 2}^i, a_{j\ avg\ 3}^i, a_{j\ avg\ 4}^i) = (\prod_{i=1}^n a_i)^{1/n} = \left( \sqrt[n]{a_1^{(i)}}, \sqrt[n]{a_2^{(i)}}, \sqrt[n]{a_3^{(i)}}, \sqrt[n]{a_4^{(i)}} \right) \quad (2)$$

Where,  $A_{j\ ave}$  represents the mean opinion of experts about the  $j$ th component.

c. Then, the difference between the opinions of experts from the mean opinions for each component was calculated using Equation (3) and was provided to the panel in the form of the next questionnaire. In this way, by taking feedback [56–62] from all members and the difference between the opinions of each expert with the group's opinions, they were asked to adjust and correct their opinions if they wish to reach a group consensus.

$$\left( a_{j\ avg\ 1} - a_1^{(i)}, a_{j\ avg\ 2} - a_2^{(i)}, a_{j\ avg\ 3} - a_3^{(i)}, a_{j\ avg\ 4} - a_4^{(i)} \right) = \left( \sqrt[n]{a_1^{(i)}} - a_1^{(i)}, \sqrt[n]{a_2^{(i)}} - a_2^{(i)}, \sqrt[n]{a_3^{(i)}} - a_3^{(i)}, \sqrt[n]{a_4^{(i)}} - a_4^{(i)} \right) \quad (3)$$

Since the last part of the questionnaire asked the subjects to state other factors that could affect the emotions of customers from their own point of view, the new proposed factors were added to the existing factors (Table 4) and were returned to the experts along with the results of Equation (3).

d. As mentioned, the secondary questionnaire was prepared based on the results of the first one. It was provided to the experts so that they can modify their opinions if they wish to learn about the results of other panel members' opinions. Also, in this questionnaire, the factors that were raised by the panel members were also provided to be reviewed and weighted by other members. The weight of

**Table 4.** Factors affecting customers' emotions from the panel's point of view.

Row	Recommended factor
1	The presence and company of a good friend in shopping
2	Courage and risk of buying
3	Religion and religious beliefs
4	The halo effect of believing in the amazing effect of luxury products
5	The influence of beauty influencers in cyberspace
6	Iranian sanctions and the non-import of luxury brands
7	Not having a purchase account from Iran
8	Marital status
9	Showing off and attracting attention
10	Currency fluctuations
11	Unfamiliarity with websites of the brands
12	Visual appeal of the group

each factor was converted into trapezoidal numbers through linguistic variables [63] according to Table 3.

$$B_j^i = (b_1^i, b_2^i, b_3^i, b_4^i) \quad i = 1, 2, 3, \dots, n$$

$$j = 1, 2, 3, \dots, m \quad (4)$$

Where  $B_j^i$  represents the  $i^{th}$  expert's opinion about the  $j^{th}$  component. The geometric mean values [64–71] of the opinions and the differences between each member's opinion from the mean were calculated based on Equations (2) and (3) as in the first step. The third and fourth phases of fuzzy Delphi are repeated until the mean values in consecutive rounds approach logically, that is until an acceptable consensus is obtained [46]. The relevant distance to reach a consensus is 0.2 [72]. Also, at this stage, the distance between the mean opinions of the first round and the mean opinions of the second round was calculated using Equation (5) [72].

$$d(B_{j\text{ ave}}, A_{j\text{ ave}}) =$$

$$\left| \frac{1}{4} [(b_{j\text{ ave } 1} + b_{j\text{ ave } 2} + b_{j\text{ ave } 3} + b_{j\text{ ave } 4}) - (a_{j\text{ ave } 1} + a_{j\text{ ave } 2} + a_{j\text{ ave } 3} + a_{j\text{ ave } 4})] \right| \quad (5)$$

Where,  $A_{j\text{ ave}}$  is the mean of the first round of opinions, and  $B_{j\text{ ave}}$  is the mean of the second round of opinions? The results are provided in Table 5. As shown in this table, the geometric mean difference between the values of the first and second rounds for 8 variables is more significant than

the acceptable threshold (0.2). Also, because factors 37 to 48 were proposed in the first round by experts and there was no evaluation in the first round, the mean difference for these factors cannot be calculated. These two reasons indicate the need for repetition of the process in the third round. d. The third round questionnaire was prepared to provide feedback for the previous round and apply the corrective opinions of the experts in order to reach a consensus. The steps taken were similar to the second round. The results of this round can also be seen in Table 5.

$$C_j^i = (c_1^i, c_2^i, c_3^i, c_4^i) \quad i = 1, 2, 3, \dots, n \\ j = 1, 2, 3, \dots, m \quad (6)$$

Where  $C_j^i$  represents  $i^{th}$  expert opinion about the  $j^{th}$  component. The results of the third round, as shown in Table 5, show that the distance between the mean opinions of the second and third rounds is in the acceptable range for all criteria, that is, a group consensus has been reached about the factors affecting the emotions of customers. e. In order to identify the factors affecting the subject under study, the last step was to analyze the defuzzified mean values of each factor. Based on the standards defined by the researchers, criteria with a value of  $5 \leq A_{j\text{ ave}}$  were considered as potential factors for the study [73]. The defuzzified mean values of experts' opinions for each factor were calculated based on Equation (7) [46].

$$K_j = \frac{(a_{j\text{ ave } 1} + a_{j\text{ ave } 2} + a_{j\text{ ave } 3} + a_{j\text{ ave } 4})}{4} \quad (7)$$

According to Table 5, the defuzzified mean values of some factors are less than the acceptable level (5) and should be removed from the list of factors affecting customer emotions. These factors include internet usage, level of education, family influence, number of group members, culture and cultural factors, religion, and religious beliefs, the halo effect of believing in the tremendous effect of luxury products", "marital status, "showing off and attracting attention" and "visual appeal". Other factors were identified as variables affecting the emotions of customers in buying luxury cosmetic products.



**Table 5.** Geometric mean difference of expert opinions and defuzzified mean values.

Row	Studied variable	Mean difference	Defuzzified mean values			
		1 <sup>st</sup> and 2 <sup>nd</sup> round	2 <sup>nd</sup> and 3 <sup>rd</sup> round	1 <sup>st</sup> round	2 <sup>nd</sup> round	3 <sup>rd</sup> round
1	Available time	0.1	0.00	6.820	6.713	6.713
2	Available money	0.05	0.00	7.553	7.501	7.501
3	Product Specifications	0.12	0.06	7.501	7.621	7.553
4	Shopping style	0.15	0.09	6.274	6.121	6.026
5	Experience	0.26	0.16	6.698	6.431	6.593
6	Internet usage time	0.12	0.11	4.964	4.844	4.728
7	Age	0.11	0.12	5.398	5.280	5.152
8	Gender	0.15	0.00	6.289	6.136	6.136
9	Income level	0.18	0.12	7.316	7.501	7.621
10	Level of education	0.11	0.00	4.252	4.138	4.138
11	Friendly relations of admin of the group	0.16	0.16	6.653	6.490	6.389
12	Psychological characteristics of the consumer	0.07	0.10	7.266	7.341	7.341
13	Economic prosperity	0.11	0.00	6.928	7.039	7.151
14	Brand image	0.11	0.00	7.266	7.382	7.382
15	Level of customer engagement with the product and brand	0.06	0.00	6.913	6.850	6.850
16	Luxury and up-to-date products	0.10	0.10	6.374	6.475	6.374
17	Diversity-seeking	0.26	0.14	5.073	5.342	5.488
18	Family influence	0.11	0.11	4.937	4.818	4.701
19	Browsing groups	0.21	0.17	6.758	6.975	7.151
20	Enjoyment of shopping	0.11	0.00	7.087	7.200	7.200
21	Method of presenting items and product photos	0.31	0.10	6.177	6.490	6.389
22	Listing and pricing in the group	0.11	0.00	6.975	7.087	7.087
23	Price is more suitable than the store and online shops	0.19	0.12	7.675	7.869	7.997
24	Group promotional activities and marketing drivers	0.12	0.00	7.501	7.621	7.621
25	The atmosphere of the group	0.17	0.11	6.866	7.039	6.928
26	Number of group members	0.07	0.00	3.943	4.021	4.021
27	Presence of friends and peers in groups	0.45	0.09	6.431	5.972	5.875
28	Shopping channel (providing invoices and showing other people's purchases)	0.11	0.00	4.006	4.116	4.116
29	Convenience and the possibility of buying all brands	0.18	0.12	7.316	7.501	7.621
30	Reliability and quality of the group	0.06	0.00	7.675	7.744	7.744
31	Customer curiosity	0.15	0.15	6.370	6.218	6.374
32	Desire to experience new products	0.22	0.18	6.162	5.933	5.751
33	Group buying versus individual group buying	0.22	0.19	5.301	5.079	4.880
34	Reading reviews and get feedback from the product and use it	0.11	0.00	4.252	4.138	4.138
35	Individual interactions in the group	0.33	0.10	6.593	6.928	6.820
36	Culture and cultural factors	0.11	0.00	4.252	4.138	4.138
37	The presence and company of a good friend in shopping	-	0.16	-	6.431	6.593
38	Courage and risk of buying	-	0.14	-	5.199	5.342
39	Religion and religious beliefs	-	0.00	-	3.624	3.624
40	The halo effect of believing in the amazing effect of luxury products	-	0.12	-	4.943	4.943
41	The influence of beauty influencers in cyberspace	-	0.14	-	5.751	5.894
42	Iranian sanctions and the non-import of luxury brands	-	0.00	-	7.621	7.621
43	Not having a purchase account from Iran	-	0.00	-	7.316	7.316
44	Marital status	-	0.00	-	3.530	3.530
45	Showing off and attracting attention	-	0.00	-	3.815	3.815
46	Currency fluctuations	-	0.14	-	6.289	6.447
47	Unfamiliarity with websites of the brands	-	0.09	-	6.177	6.081
48	Visual appeal of the group	-	0.11	-	4.575	4.465

The Delphi analysis aims to identify the variables affecting the emotions of customers through group consensus. Finally, 36 factors were identified as effective, which were prioritized based on the importance of each one and can be seen in Table 6. Then, based on the basics and common features, according to Table 7, they were grouped into three categories of personal, situational, product, and group variables.

**Table 6.** Antecedents affecting customer emotions in buying luxury cosmetics and hygiene products.

Significance rank of the factor	Factors affecting customer emotions	Significance rank of the factor	Factors affecting customer emotions
1	More economic prices than physical stores and online shops	14	Individual interactions in the group
2	Reliability and quality of the group	15	Time available
2	Group promotional activities and marketing incentives	16	Experience
2	Iranian sanctions and the non-importation of luxury brands	16	The presence and company of a good friend in shopping
2	Convenience and the possibility of buying all brands	17	Currency fluctuations
2	Income level	18	Method of presenting items and product photos
3	Product Specifications	18	Friendly relations of group admin
4	Available money	19	Luxury products commensurate with modern fashion
5	Brand image	19	Customer curiosity
6	Psychological characteristics of consumers	20	Gender
7	Not having a purchase account in Iran	21	Unfamiliarity with shopping style
8	Reading reviews and get product feedback	22	Brand websites
9	Pleasure of shopping	23	Effect of beauty influencers in cyberspace
10	Browsing groups	24	Presence of friends and peers in groups
10	Economic prosperity	25	Desire to experience new products
11	Method of listing and pricing in the group	26	Diversity seeking
12	Atmosphere of the group	27	Courage and risk of buying
13	Mental engagement with the product and brand	28	Age

**Table 7.** Personal, situational, product and group variables affecting emotions.

Variable	Effective factors
Group and product variables	Method of presenting items and provide product photos, method of listing and pricing in the group, economic prices than physical stores and online shops, the atmosphere (environment) of the group, reliability and quality of the group, product specifications, group's promotional activities and marketing stimuli, convenience and the possibility of buying, friendly relationships with the admin of groups, brand image, luxury products commensurate with the latest fashion, familiarity with the admin of the group or website of all luxury brands, reading comments and receiving feedback from the product
Situational variables	Available time, available money, economic well-being, influence of beauty influencers in cyberspace, Iranian sanctions and non-import of luxury brands, not having a purchase account from Iran, currency fluctuations, presence and company of a good friend (partner) in purchases, presence of friends and peers in groups
Personal variables	Being curious, becoming a customer in groups, boldness and risk-taking, desire to experience new products, degree of mental involvement with the product and brand, being enjoyable or hedonistic buying, diversity-seeking, age, gender, consumer psychological characteristics (introversion, being conservative), interactions of the individual in the group

## 5. Discussion

According to previous studies about customer emotions, this study expanded this concept for Iranian customers by examining the luxury cosmetics industry, considering the specific situation of Iran and the Iranian sanctions. Also, this study tried to expand the knowledge about factors affecting customers' emotions and theoretical and empirical evidence of consumer behavior marketing basics. For this purpose, a two-stage research method was used to identify the antecedents affecting customers' emotions in purchasing luxury cosmetic products. The first stage included a qualitative study through interviews with the customers of such products and led to the thematic diagram of emotions, customers, dimensions, and effective factors. The results of interviews with customers and real buyers of luxury cosmetic products from Telegram groups who experience different emotions during the presence and purchase process, along with a review of available resources, form the basis of semi-structured questionnaires. Data analysis was performed in this stage using the thematic analysis method. As the results of the thematic analysis showed, the emotions of customers in Telegram groups include a range of positive and negative emotions, which are consistent with the findings of

[9,17,20,21] and [18]. Most cases mentioned in the interview with the members of Telegram groups selling luxury cosmetic products were related to happiness and pleasure. After happiness and pleasure, "Enthusiasm and excitement", "positive surprise", "relaxation and confidence", and "love and being emotional", are, respectively, the sources of positive emotions for the interviewees. These cases have been conceptualized by creating purchase incentives and stimulating buyers' emotions toward luxury cosmetics and health products during decision-making, in the form of a more general theme of positive customer emotions. Another part of customers' emotions influencing their buying behavior is negative emotions that consumers tend to minimize in making decisions [74–77]. These cases include sadness, fear, regret and feeling of inferiority, anger, jealousy, and despair; the most important of which is fear. These components were conceptualized by arousing the emotions of buyers of luxury cosmetic products in the overall concept of negative emotions. In the second stage, in order to provide a comprehensive picture of the factors affecting the emotions and emotional purchase, after reviewing various studies, the fuzzy Delphi method was used to obtain group consensus, and identify and prioritize the factors that might be effective in customer emotions. After three rounds of evaluation and comparison of opinions by the panel members, 36 factors were identified as potentially effective ones that can affect the emotions of customers when they try to choose and buy cosmetic products. Based on their importance in terms of the impact they could have, these factors were classified according to the studied concept. According to the final results, the factor of "more economic price than physical stores and online shops" was ranked first, and the two factors of "credibility and quality of the group", as well as "Iranian sanctions and the non-import of luxury brands", were ranked second, which were not mentioned in previous studies. The advertising activities of the group and marketing drivers and income level were ranked second as other influential factors, which is consistent with [25] and Ciunova Shuleska [24]. This shows that the emotions of Iranian customers are mostly influenced by product group factors and, thereafter, situational factors. Although personal factors are potentially influential, they are more influenced by other factors. These findings are consistent with the markets of luxury products through online networks, including Telegram, which is a relatively new and attractive market for Iranian society and provides valuable insight into Iranian customer behavior.

## 6. Limitations of the Study

- (1) This study considers the topic of customer emotions only for a specific sector, i.e. luxury cosmetic products, and its results face limitations when generalizing to other areas, products, and industries. Despite that, due to the importance of customer emotions, the need arises to study this phenomenon in different contexts as well as for other products.
- (2) The statistical population studied here includes members of telegram groups selling luxury cosmetic products, which are dominated by women. Therefore, it is expected to limit the generalizability of the results to other consumer communities. Accordingly, the generalization of these results to the larger community should take place with enough consideration.

## 7. Future Studies

- (1) Based on the first limitation of the study, due to the importance of customer emotions, researchers are recommended study the wide dimensions of this phenomenon in the field of online shopping in different virtual sales platforms and with different products in order to help improve the relevant knowledge in the country.
- (2) Researchers can obtain valuable results and findings in this field by studying diverse statistical communities, for example, one that includes both female and male buyers, or if possible, by studying the statistical population of consumers across the country.

## References

1. Jain, S. Factors affecting sustainable luxury purchase behavior: A conceptual framework. *Journal of International Consumer Marketing* **2019**, *31*, 130–146.

2. Ladhari, R. The effect of consumption emotions on satisfaction and word-of-mouth communications. *Psychology & Marketing* **2007**, *24*, 1085–1108.
3. Zam, M.; Tavakoli, M.; Ramezani, H.; Rezasoltani, A. The relationship between consuming fashion and self-confidence on the buying behaviour in the clothing market as a mediator **2022**.
4. Zam, M.; Rezasoltani, A.; Ramezani, H.; Tavakoli, M. Effects of psychological factors on customer behavior in e-transactions **2022**.
5. Zam, M.; Tavakoli, M.; Ramezani, H.; Rezasoltani, A. Assessing the different aspects of consuming fashion and the role of self-confidence on the buying behaviour of fashion consumers in the clothing market as a mediator. *arXiv preprint arXiv:2209.02367* **2022**.
6. Lin, L.Y.; Liao, J.C. The influence of store image and product perceived value on consumer purchase intention. *International Journal of Advanced Scientific Research and Technology* **2012**, *2*, 306–321.
7. Husnain, M.; Rehman, B.; Syed, F.; Akhtar, M.W. Personal and in-store factors influencing impulse buying behavior among generation Y consumers of small cities. *Business Perspectives and Research* **2019**, *7*, 92–107.
8. Wijaya, O.Y.A.; Ardyan, E. The influencing factors of impulsive buying behaviour in Transmart Carrefour Sidoarjo **2018**.
9. Kim, J.; Lennon, S.J. Effects of reputation and website quality on online consumers' emotion, perceived risk and purchase intention: Based on the stimulus-organism-response model. *Journal of Research in Interactive Marketing* **2013**.
10. Prayag, G.; Hosany, S.; Muskat, B.; Del Chiappa, G. Understanding the relationships between tourists' emotional experiences, perceived overall image, satisfaction, and intention to recommend. *Journal of travel research* **2017**, *56*, 41–54.
11. Senturk, H.A.; Cizer, E.O.; Sezer, T. The Effects of Real-Time Content Marketing on Consumer Emotions and Behaviors: An Analysis on COVID-19 Pandemic Period. In *Cases on Digital Strategies and Management Issues in Modern Organizations*; IGI Global, 2022; pp. 300–329.
12. Nguyen, T.M.H. The impact of emotions on customer experience through using mobile application for food ordering in Finland **2018**.
13. Plutchik, R.; Kellerman, H. *Emotion Profile Index*; Western Psychological Services, 1974.
14. Boyle, G.J. Reliability and validity of Izard's differential emotions scale. *Personality and individual Differences* **1984**, *5*, 747–750.
15. Tronvoll, B. Negative emotions and their effect on customer complaint behaviour. *Journal of Service Management* **2011**.
16. Khan, N.; Hui, L.H.; Chen, T.B.; Hoe, H.Y. Impulse buying behaviour of generation Y in fashion retail. *International Journal of Business and Management* **2016**, *11*, 144.
17. Kim, S.; Park, G.; Lee, Y.; Choi, S. Customer emotions and their triggers in luxury retail: Understanding the effects of customer emotions before and after entering a luxury shop. *Journal of Business Research* **2016**, *69*, 5809–5818.
18. Souki, G.Q.; Antonialli, L.M.; Barbosa, A.A.d.S.; Oliveira, A.S. Impacts of the perceived quality by consumers' of à la carte restaurants on their attitudes and behavioural intentions. *Asia Pacific Journal of Marketing and Logistics* **2020**, *32*, 301–321.
19. Lo, A.; Wu, C.; Tsai, H. The impact of service quality on positive consumption emotions in resort and hotel spa experiences. *Journal of Hospitality Marketing & Management* **2015**, *24*, 155–179.
20. Pappas, I.O.; Kourouthanassis, P.E.; Giannakos, M.N.; Chrissikopoulos, V. Explaining online shopping behavior with fsQCA: The role of cognitive and affective perceptions. *Journal of Business Research* **2016**, *69*, 794–803.
21. Makkonen, M.; Riekkinen, J.; Frank, L.; Jussila, J. The effects of positive and negative emotions during online shopping episodes on consumer satisfaction, repurchase intention, and recommendation intention. Bled eConference. University of Maribor, 2019.
22. Ribeiro, M.A.; Prayag, G. Perceived quality and service experience: Mediating effects of positive and negative emotions. *Journal of Hospitality Marketing & Management* **2019**, *28*, 285–305.
23. Verplanken, B.; Herabadi, A. Individual differences in impulse buying tendency: Feeling and no thinking. *European Journal of personality* **2001**, *15*, S71–S83.
24. Ciunova-Shuleska, A. The impact of situational, demographic, and socioeconomic factors on impulse buying in the republic of Macedonia. *Journal of East-West Business* **2012**, *18*, 208–230.

25. Badgaiyan, A.J.; Verma, A. Does urge to buy impulsively differ from impulsive buying behaviour? Assessing the impact of situational factors. *Journal of Retailing and Consumer Services* **2015**, *22*, 145–157.
26. Miao, M.; Jalees, T.; Qabool, S.; Zaman, S.I. The effects of personality, culture and store stimuli on impulsive buying behavior: Evidence from emerging market of Pakistan. *Asia Pacific Journal of Marketing and Logistics* **2020**, *32*, 188–204.
27. Sharma, P.; Sivakumaran, B.; Marshall, R. Impulse buying and variety seeking: A trait-correlates perspective. *Journal of Business research* **2010**, *63*, 276–283.
28. Beatty, S.E.; Ferrell, M.E. Impulse buying: Modeling its precursors. *Journal of retailing* **1998**, *74*, 169–191.
29. Muruganantham, G.; Bhakat, R.S. A review of impulse buying behavior. *International journal of marketing studies* **2013**, *5*, 149.
30. Wang, J.; Gu, L.; Aiken, M. A study of the impact of individual differences on online shopping. *International Journal of E-Business Research (IJEER)* **2010**, *6*, 52–67.
31. Cheng, H.H. The effects of product stimuli and social stimuli on online impulse buying in live streams. Proceedings of the 7th International Conference on Management of e-Commerce and e-Government, 2020, pp. 31–35.
32. Ali Taha, V.; Pencarelli, T.; Škerháková, V.; Fedorko, R.; Košíková, M. The use of social media and its impact on shopping behavior of Slovak and Italian consumers during COVID-19 pandemic. *Sustainability* **2021**, *13*, 1710.
33. Yang, Z.; Babapour, H. Critical variables for assessing the effectiveness of electronic customer relationship management systems in online shopping. *Kybernetes* **2022**.
34. Khan, R.U.; Salameh, Y.; Iqbal, Q.; Yang, S. The impact of customer relationship management and company reputation on customer loyalty: The mediating role of customer satisfaction. *Journal of Relationship Marketing* **2022**, *21*, 1–26.
35. An, M.a.; Han, S.L. Effects of experiential motivation and customer engagement on customer value creation: Analysis of psychological process in the experience-based retail environment. *Journal of Business Research* **2020**, *120*, 389–397.
36. Karim, N.U.; Nisa, U.; Imam, S.S. Investigating the factors that impact online shopping and sales promotion on consumer's impulse buying behavior: a gender-based comparative study in the UAE. *International Journal of Business and Administrative Studies* **2021**, *7*, 14–26.
37. Braun, V.; Clarke, V. Using thematic analysis in psychology. *Qualitative research in psychology* **2006**, *3*, 77–101.
38. Tajdari, M.; Pawar, A.; Li, H.; Tajdari, F.; Maqsood, A.; Cleary, E.; Saha, S.; Zhang, Y.J.; Sarwark, J.F.; Liu, W.K. Image-based modelling for adolescent idiopathic scoliosis: mechanistic machine learning analysis and prediction. *Computer methods in applied mechanics and engineering* **2021**, *374*, 113590.
39. Tarvirdizadeh, B.; Golgouneh, A.; Tajdari, F.; Khodabakhshi, E. A novel online method for identifying motion artifact and photoplethysmography signal reconstruction using artificial neural networks and adaptive neuro-fuzzy inference system. *Neural Computing and Applications* **2020**, *32*, 3549–3566.
40. Ghaffari, A.; Khodayari, A.; Kamali, A.; Tajdari, F.; Hosseinkhani, N. New fuzzy solution for determining anticipation and evaluation behavior during car-following maneuvers. *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of automobile engineering* **2018**, *232*, 936–945.
41. Khodayari, A.; Ghaffari, A.; Kamali, A.; Tajdari, F. A new model of car following behavior based on lane change effects using anticipation and evaluation idea. *Iranian Journal of Mechanical Engineering Transactions of the ISME* **2015**, *16*, 26–38.
42. Tajdari, F.; Kabgani, M.; Rad, N.F.; Khodabakhshi, E. Robust control of a 3-dof parallel cable robot using an adaptive neuro-fuzzy inference system. 2017 Artificial Intelligence and Robotics (IRANOPEN). IEEE, 2017, pp. 97–101.
43. Tarvirdizadeh, B.; Golgouneh, A.; Khodabakhshi, E.; Tajdari, F. An assessment of a similarity between the right and left hand photoplethysmography signals, using time and frequency features of heart-rate-variability signal. 2017 IEEE 4th international conference on knowledge-based engineering and innovation (KBEI). IEEE, 2017, pp. 0588–0594.
44. Tajdari, F.; Toulkani, N.E.; Zhiakzadeh, N. Intelligent optimal feed-back torque control of a 6dof surgical rotary robot. 2020 11th Power Electronics, Drive Systems, and Technologies Conference (PEDSTC). IEEE, 2020, pp. 1–6.



45. Tajdari, F.; Ghaffari, A.; Khodayari, A.; Kamali, A.; Zhilakzadeh, N.; Ebrahimi, N. Fuzzy control of anticipation and evaluation behaviour in real traffic flow. 2019 7th International Conference on Robotics and Mechatronics (ICRoM). IEEE, 2019, pp. 248–253.
46. Cheng, C.H.; Lin, Y. Evaluating the best main battle tank using fuzzy decision theory with linguistic criteria evaluation. *European journal of operational research* **2002**, *142*, 174–186.
47. Tajdari, F.; Ebrahimi Toulkani, N. Implementation and intelligent gain tuning feedback-based optimal torque control of a rotary parallel robot. *Journal of Vibration and Control* **2022**, *28*, 2678–2695.
48. Tajdari, F.; Tajdari, M.; Rezaei, A. Discrete time delay feedback control of stewart platform with intelligent optimizer weight tuner. 2021 IEEE International Conference on Robotics and Automation (ICRA). IEEE, 2021, pp. 12701–12707.
49. Tajdari, F.; Toulkani, N.E.; Nourimand, M. Intelligent architecture for car-following behaviour observing lane-changer: Modeling and control. 2020 10th International Conference on Computer and Knowledge Engineering (ICCCKE). IEEE, 2020, pp. 579–584.
50. Gírbés-Juan, V.; Armesto, L.; Hernández-Ferrándiz, D.; Dols, J.; Sala, A.; Zhang, T.; Wang, J.; Zhang, L.; Guo, L.; Chen, J.; others. Simultaneous Intelligent Anticipation and Control of Follower Vehicle Observing Exiting Lane Changer..... F. Tajdari, A. Golgouneh, A. Ghaffari, A. Khodayari, A. Kamali, and N. Hosseinkhani 8567 Road Garbage Segmentation and Cleanliness Assessment Based on Semantic Segmentation Network for Cleaning Vehicles..... J. Liao, X. Luo, L. Cao, W. Li, X. Feng, J. Li, and F. Yuan 8578 Two-Stage Synthetic Optimization of Supercapacitor-Based Energy Storage Systems, Traction Power Parameters and.
51. Tajdari, F.; Golgouneh, A.; Ghaffari, A.; Khodayari, A.; Kamali, A.; Hosseinkhani, N. Simultaneous intelligent anticipation and control of follower vehicle observing exiting lane changer. *IEEE Transactions on Vehicular Technology* **2021**, *70*, 8567–8577.
52. Tajdari, F. Adaptive time-delay estimation and control of optimized Stewart robot. *Journal of Vibration and Control* **2022**, p. 10775463221137141.
53. Tajdari, M.; Tajdari, F.; Shirzadian, P.; Pawar, A.; Wardak, M.; Saha, S.; Park, C.; Huysmans, T.; Song, Y.; Zhang, Y.J.; others. Next-generation prognosis framework for pediatric spinal deformities using bio-informed deep learning networks. *Engineering with Computers* **2022**, *38*, 4061–4084.
54. Tajdari, F.; others. Optimal and adaptive controller design for motorway traffic with connected and automated vehicles **2023**.
55. Dalkey, N.; Helmer, O. An experimental application of the Delphi method to the use of experts. *Management science* **1963**, *9*, 458–467.
56. Tajdari, F.; Roncoli, C.; Papageorgiou, M. Feedback-based ramp metering and lane-changing control with connected and automated vehicles. *IEEE Transactions on Intelligent Transportation Systems* **2020**, *23*, 939–951.
57. Golgouneh, A.; Bamshad, A.; Tarvirdizadeh, B.; Tajdari, F. Design of a new, light and portable mechanism for knee CPM machine with a user-friendly interface. 2016 Artificial Intelligence and Robotics (IRANOPEN). IEEE, 2016, pp. 103–108.
58. Tajdari, F.; Roncoli, C.; Bekiaris-Liberis, N.; Papageorgiou, M. Integrated ramp metering and lane-changing feedback control at motorway bottlenecks. 2019 18th European Control Conference (ECC). IEEE, 2019, pp. 3179–3184.
59. Tajdari, F.; Khodabakhshi, E.; Kabganian, M.; Golgouneh, A. Switching controller design to swing-up a two-link underactuated robot. 2017 IEEE 4th International Conference on Knowledge-Based Engineering and Innovation (KBEI). IEEE, 2017, pp. 0595–0599.
60. Tajdari, F.; Kabganian, M.; Khodabakhshi, E.; Golgouneh, A. Design, implementation and control of a two-link fully-actuated robot capable of online identification of unknown dynamical parameters using adaptive sliding mode controller. 2017 Artificial Intelligence and Robotics (IRANOPEN). IEEE, 2017, pp. 91–96.
61. Tajdari, F.; Toulkani, N.E.; Zhilakzadeh, N. Semi-real evaluation, and adaptive control of a 6dof surgical robot. 2020 11th Power Electronics, Drive Systems, and Technologies Conference (PEDSTC). IEEE, 2020, pp. 1–6.
62. Tajdari, F.; Roncoli, C. Adaptive traffic control at motorway bottlenecks with time-varying fundamental diagram. *IFAC-PapersOnLine* **2021**, *54*, 271–277.

63. Rezasoltani, A.; Saffari, E.; Konjani, S.; Ramezani, H.; Zam, M. Exploring the Viability of Robot-supported Flipped Classes in English for Medical Purposes Reading Comprehension. *arXiv preprint arXiv:2208.07442* **2022**.
64. Yang, Y.; Yuan, T.; Huysmans, T.; Elkhuisen, W.S.; Tajdari, F.; Song, Y. Posture-invariant three dimensional human hand statistical shape model. *Journal of Computing and Information Science in Engineering* **2021**, *21*.
65. Tajdari, F.; Huysmans, T.; Yang, Y.; Song, Y. Feature preserving non-rigid iterative weighted closest point and semi-curvature registration. *IEEE Transactions on Image Processing* **2022**, *31*, 1841–1856.
66. Tajdari, F.; Eijck, C.; Kwa, F.; Versteegh, C.; Huysmans, T.; Song, Y. Optimal position of cameras design in a 4D foot scanner. International design engineering technical conferences and computers and information in engineering conference. American Society of Mechanical Engineers, 2022, Vol. 86212, p. V002T02A044.
67. Tajdari, F.; Kwa, F.; Versteegh, C.; Huysmans, T.; Song, Y. Dynamic 3d mesh reconstruction based on nonrigid iterative closest-farthest points registration. International design engineering technical conferences and computers and information in engineering conference. American Society of Mechanical Engineers, 2022, Vol. 86212, p. V002T02A051.
68. Minnoye, A.L.; Tajdari, F.; Doubrovski, E.L.; Wu, J.; Kwa, F.; Elkhuisen, W.S.; Huysmans, T.; Song, Y. Personalized product design through digital fabrication. International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. American Society of Mechanical Engineers, 2022, Vol. 86212, p. V002T02A054.
69. Tajdari, M.; Tajdari, F.; Pawar, A.; Zhang, J.; Liu, W.K. 2D to 3D volumetric reconstruction of human spine for diagnosis and prognosis of spinal deformities. Conference: 16th US national congress on computational mechanics, 2021.
70. Tajdari, F.; Huysmans, T.; Song, Y. Non-rigid registration via intelligent adaptive feedback control. *IEEE transactions on visualization and computer graphics* **2023**, pp. 1–16.
71. Tajdari, F.; Huysmans, T.; Xu, J.; Yao, X.; Song, Y. 4D Feet: Registering Walking Foot Shapes Using Attention Enhanced Dynamic-Synchronised Graph Convolutional LSTM Network. 2019 IEEE/CVF International Conference on Computer Vision (ICCV). IEEE, 2019, pp. 10441–10450.
72. Aghayari, J.; Valmohammadi, C.; Alborzi, M. Research Article Explaining the Effective Factors on Digital Transformation Strategies in the Telecom Industry of Iran Using the Delphi Method **2022**.
73. Murgante, B.; Eskandari Sani, M.; Pishgahi, S.; Zarghamfard, M.; Kahaki, F. Factors affecting the Lut desert tourism in Iran: Developing an interpretive-structural model. *Sustainability* **2021**, *13*, 7245.
74. Tajdari, F.; Ramezani, H.; Paydarfar, S.; Lashgari, A.; Maghrebi, S. Flow metering and lane-changing optimal control with ramp-metering saturation. 2022 CPSSI 4th International Symposium on Real-Time and Embedded Systems and Technologies (RTEST). IEEE, 2022, pp. 1–6.
75. Tajdari, F.; Roncoli, C. Online set-point estimation for feedback-based traffic control applications. *arXiv preprint arXiv:2207.13467* **2022**.
76. Tajdari, F.; Roncoli, C. Online set-point estimation for feedback-based traffic control applications. *arXiv preprint arXiv:2207.13467* **2022**.
77. Roncoli, C.; Tajdari, F.; Bekiaris-Liberisb, N.; Papageorgioub, M. Integrated control of motorway bottlenecks via flow metering and lane assignment.