

## WHAT DRIVES CONSUMER SHOPPING BEHAVIOR IN LIVE STREAMING COMMERCE?

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### ABSTRACT

Drawing upon the stimulus–organism–response framework, this study investigates contextual and environmental stimuli effects (streamer attractiveness, para-social interactions, and information quality) from a live streaming commerce context on viewer's cognitive and emotional states (cognitive assimilation and arousal) and their subsequent responses (hedonic consumption, impulsive consumption, and social sharing). Based on 300 valid survey data, we found 1) the three stimuli have direct effects on cognitive and emotional states, and cognitive and emotional states have direct effects on three responses, 2) the streamer attractiveness and para-social interaction effects on the three responses are mediated by arousal. However, cognitive assimilation only mediates the information quality effect on the three responses. These findings provide insights into how live streaming stimuli influence consumer's cognitive and emotional states, in turn influencing consumer behavior in a live streaming commerce context.

Keywords: Live streaming commerce; Stimulus-Organism-Response; Para-social interaction; Arousal; Social sharing

### 1. Introduction

E-commerce development is experiencing an evolution through the adoption of various types of emerging novel applications to enhance customer participation and achieve greater economic value [Huang and Benyoucef 2013]. As an interactive multimedia platform providing entertainment, social and commercial activities, live streaming has gained in popularity since 2011 [Hilvert-Bruce et al. 2018]. According to the Interactive Advertising Bureau [IAB, May 2018], 47% of live streaming viewers worldwide spend more time watching live streaming compared with a year ago [Emarketer 2018]. From a retailer's perspective, taking advantage of live streams opens up a wealth of opportunities in marketing, customer service, and revenue. There is no wonder that major retailers like Amazon and QVC operated their own live video shopping platforms in 2019 [Wowza Media Systems 2019]. China had up to 433 million live streaming viewers in August 2019 [CNNIC 2019]. The use of live streaming to promote brands and products is “exploding” in the E-commerce field in China [Aliresearch 2020]. For example, during the “June 18” event in 2019, Taobao's live streaming platform drove sales of 13 billion yuan, with the number of merchants broadcasting live streaming increasing by nearly 120% year-on-year. The number of broadcasts grew by 150% year-

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on-year [CNNIC 2019]. Great changes can be seen when applying live streaming commerce compared to more conventional marketing strategies.

With the integration of live streaming in e-commerce, greater potential is created to provide customers a richer shopping experience that is interactive, in real-time and reality based within an interactive cyber-physical environment [Sun et al., 2019]. This innovative live streaming commerce has shifted e-commerce from being a product oriented shopping environment to a social, hedonic, and customer-centered environment [Busalim 2016; Wongkitrungrueng and Assarut 2018]. Consumers are presented a virtual shopping environment that provides a variety of shopping and contextual cues in novel fashions that have enriched traditional commerce in several ways [Sun et al. 2019]. For instance, consumers can make more informed purchase decisions due to improved information quality (e.g., information regarding the product, brand, using tips, and manufacturing processes), as information in the virtual streaming commerce environment is in the form of real-time videos that are extensively different from traditional online shopping, where customers can only receive information through pictures and text [Wongkitrungrueng and Assarut 2018]. Moreover, harmonious and inter-personal relationships between sellers/streamers and consumers are easily developed with the assistance of advanced streaming commerce technology (e.g., bullet-screen, real-time videos) [Hu et al. 2017; Wongkitrungrueng and Assarut 2018]. Sun et al. [2019] pointed out that traditional online channel sellers lacked face-to-face real-time interactions with their customers. The para-social relationship in streaming commerce, such as the sense of intimacy and closeness with streamers [Hu et al. 2017], can serve as a critical behavioral facilitator in the streaming commerce shopping environment. In addition, streaming commerce enables the streamers to “reveal their faces, offices/homes, and personalities” in real time [Wongkitrungrueng and Assarut 2018]. The shopper’s attractiveness and influence are important in intriguing consumers to indulge in the streaming commerce environment [Cai et al. 2018]. Hence, live streaming commerce has provided customers with a holistic channel where consumers are able to enjoy hedonic, social and shopping benefits via a greatly enhanced purchasing and socialization process. In other words, consumers may conduct a variety of behaviors while indulging in streaming commerce. For example, due to the strong social elements embedded in streaming commerce, customers may conduct more socially related behavior, such as sharing shopping experiences and products within their social networks. Due to the hedonic nature of streaming commerce, customers may hedonically consume to obtain enjoyment and novelty. Due to the enthusiastic atmosphere and high involvement in the shopping environment, customers’ emotions may be extensively aroused and thus, evoked to conduct impulsive consumption.

Although live streaming commerce is a flourishing practical field, academia has paid unequal attention to it [Hu et al. 2017], especially, studies regarding the factors influencing viewers’ behaviors [Sun et al. 2019]. Prior research explores the critical factors influencing purchase intention or engagement in live streaming commerce [e.g., Sun et al. 2019; Yu et al. 2018] from a piecemeal fashion including the customer value perspective (e.g. utilitarian, hedonic and symbolic value) [e.g., Wongkitrungrueng and Assarut 2018], IT affordance factors (e.g. visibility affordance, meta-voicing affordance, guidance shopping affordance [e.g., Sun et al. 2019], and the celebrity endorsement and match-up perspective [e.g., Park and Lin 2020]. Cai [2019] conducted content analysis to identify the utilitarian and hedonic motivations for live streaming shopping. In addition, existing studies examined how environmental attributes, e.g., information features, website content and customer services, affect the consumers' emotion and cognition states in triggering online shopping decisions, such as satisfaction, consumption, and impulse buying [Chan et al. 2017; Vieira 2013]. However, the critical contextual cues determining viewers’ response behaviors are likely to have changed within live streaming commerce environments due to greater environmental affordances (e.g. advanced technology and novel shopping facilitations) enabling consumer information absorption and interaction. Within such a shopping environment, potential consumers can make stimulated shopping decisions, conduct purchases to enjoy the excitement and pleasure of the shopping events, and engage in social activities [Chen et al. 2017], leading to the creation of more potential shopping opportunities and sustainable consumers [Zhang and Benyoucef 2016].

Streaming commerce creates a novel shopping environment that provides multiple stimuli to motivate potential consumers to indulge in their shopping behaviors. Live streaming commerce is a novel business model that has not been fully explored [Sun et al. 2019]. Researchers have suggested that a deeper understanding of internet consumer behavior processes based on the effects of contextual cues is becoming increasingly important [Floh and Madlberger 2013; Liu et al. 2013; Mosquera et al. 2017]. In addition, there is little research from the entire, holistic customer environment interaction perspective to investigate what factors or how contextual cues influence live streaming customer behavior [Wongkitrungrueng and Assarut 2018]. To bridge the aforementioned gaps, accordingly, two research questions are proposed: (1) What contextual cues influence consumer’s emotional and cognitive decision processes in live streaming commerce? (2) How do the contextual cues and decision processes affect consumer behavior? In addressing the aforementioned issues, the Stimuli-Organism-Response (S-O-R) framework is salient.

Within the live streaming commerce context, the viewer is stimulated by numerous stimuli, and the consequential shopping activity is undertaken by a stimulated consumer. The S-O-R premise is that stimulating cues, referred to as stimuli, can trigger an individual's emotional and cognitive process (organism), resulting in approaching behaviors (response) [Donovan et al. 1994]. This framework helps to explore live stream contextual factors and how these factors influence consumer behavior.

The remainder of this paper is organized as follows. In the next section we outline the live streaming commerce concepts, introduce the S-O-R framework, formulate a research framework and specify the relationships between identified constructs to explain how stimuli influence consumer's cognitive and emotional states, and in turn influence consumer behavior in a live streaming commerce context. Subsequently, we describe the empirical research methods and measurements and then analyze the data. Finally, we discuss the managerial and research implications along with future research directions.

## **2. Theoretical Development and Research Model**

### **2.1. Live Streaming Commerce**

Live streaming commerce refers to the delivery of e-commerce activities and transactions via a live streaming platform. It involves a live streaming space, live streaming technology and infrastructure to provide a cyber environment that provides real time interaction, entertainment, social activities and commerce with seamless affordance cues. In such an environment, the live streaming space creates a virtual space for streamers to stream and provides viewers a channel to watch and interact with a streamer. In traditional e-commerce, consumers can only browse one-way and read static product content (e.g. text, pictures, and pre-recorded videos) online to obtain product information. In the shopping process, consumers need to spend time and effort to search for products, read the product information carefully, compare alternative products and make evaluations based on different kinds of information, such as, from other un-known consumers' comments. Hence, there are few social factors and hedonic experiences involved in these commercial activities. Today, streaming commerce has emerged and shows great potential as a novel business model to add dynamic real-time interaction among sellers (streamers) and viewers (consumers), provide accurate information, and involve hedonic factors to attract consumers to indulge in consumption processes. Viewers are enabled to obtain dynamic and accurate information by watching live streams, develop virtual social relationships with streamers, and enjoy relaxing and entertaining hours while watching attractive streamers [Sjöblom and Hamari 2017]. Consequently, live streaming commerce has integrated commerce, social activities and hedonic factors in a seamless way. Within live streaming commerce an attractive streamer's performance usually constitutes the major content that promotes commercial information in live streaming commerce. A streamer, usually a KOL (key opinion leader, e.g. a popular V-blogger), has his or her own streaming style, specialty, personality or attractiveness [Zhao et al. 2018]. They have developed a reputation as a credible source that has attracted followers and fans. When they broadcast as endorsers of products and brands, the combination of the cyber physical environment and streamer attractiveness enables viewers to obtain appropriate information about products or brands. Streamers usually present product information by integrating their own user experience and critical comments with product details, such as packaging, major functions, and usage tips. Such information provides viewers with useful product information. Moreover, having live interaction with streamers, viewers can obtain instant and personalized product information which best fits their needs. In addition, streamers present viewers with actual product usage information, pleasure and experience [Chen and Lin 2018]. Warm human contact is developed in live streaming commerce, which may not only facilitate viewers to understand a product, but also develop emotional engagement.

Live streaming commerce not only enables viewers to experience shopping benefits (e.g. high quality product information), but also assists in developing virtual social relationships with streamers during real-time interactions, thus, generating a sense of intimacy and closeness with the live streamer, referred to as a para-social relationship [Hilvert-Bruce et al. 2018]. Live streaming commerce enables a novel relationship between the content provider and media consumer, thus enhancing the interaction between the two participants [Sjöblom and Hamari 2017]. The para-social relationship can also be reinforced when the viewers have a good usage experience with the products promoted by the streamer, increasing the trust and affection regarding the streamer. Hence, in this shopping scenario, viewers are attracted, generate interest and absorb product information and recommendation naturally while watching a streamer's stream. Importantly, viewers feel like they are present at a live-show event [Chen and Lin 2018]. Viewers are often aroused and feel excited due to the highly interactive experience, the entertaining content, and novelty of shopping on it [Alizila 2016]. They feel stimulated in this novel scenario, since they are not only witnessing, but also participating in and creating this event. Consequently, the cognitive and emotional states derived from these features provide a rich multitude of user experiences, and generates greater motivation to drive consumption behaviors, such as impulsive and hedonic consumption [Park and Zhao 2016]. In addition, viewers

obtain rich experiences, such as watching the live stream, interacting with the streamer, feelings of arousal, the product, etc., all becoming social topics. Viewers may further want to share their experience in their social networks, such as sharing information with friends on social network sites, e.g. Facebook, We-chat, Micro-blog, and Twitch.

Currently, research on live streaming commerce is limited [Sun et al. 2019]. Specifically, Sun et al. [2019] applied the IT affordance factors (e.g. visibility affordance; meta-voicing affordance; guidance shopping affordance) to explore the consumer engagement and purchase intention in the live streaming environment. Similarly, Zhang et al [2020] indicated that live streaming strategy improved customers' online purchase intention by reducing psychological distance and perceived uncertainty. Hu and Chaudhry [2020] found that social and structural bonds positively affect consumer engagement directly and indirectly via affective commitment on consumer engagement. Park and Lin [2020] adopted the perspective of celebrity endorsement and match-ups to study the intention to buy in live streaming commerce. Cai et al [2018] applied content analysis to identify the hedonic and utilitarian motivations of live streaming shopping. Wongkitrungrueng and Assarut [2018] took the SOR perspective and investigated the customer value effects (e.g. utilitarian, hedonic and symbolic value) on live streaming commerce consumers' engagement. Due to the unique features of live streaming commerce and the call for research on the contextual cue effects from prior research [Floh and Madlberger 2013; Liu et al. 2013; Mosquera et al. 2017], this study contributes to the current literature in the following ways. First, while previous studies focused mainly on the impact of certain live streaming attributes on behavior [e.g., Sun et al. 2019; Wongkitrungrueng and Assarut 2018], our study intends to further uncover the contextual cues beyond the general customer values or IT features in a novel research context. Second, existent literature regarding indulgence in the novel live streaming commerce atmosphere and how consumers' cognitions and emotional reactions are evoked is lacking. Our research further investigates the contextual cue mechanism that influences cognitive/emotional reactions. Third, live streaming commerce provides the consumer with a hybrid of social, commercial, and hedonic scenarios. This triggers consumer participation in both consumption (e.g., impulsive and hedonic consumption) and social behaviors. Prior studies focused mainly on the intention to buy or engagement. Our study enriches the current literature by further considering these multi-dimensional behaviors that represent the uniqueness of live streaming commerce.

## 2.2. Stimulus-Organism-Response Framework and Construct Identification

The Stimulus-Organism-Response (S-O-R) framework was proposed by Mehrabian and Russell [1974], which was later modified by Jacoby [2002]. Three crucial elements are included in this framework, including stimulus, organism and response. This framework suggests that the stimulating cues can trigger an individual's (organism) emotional and cognitive process, resulting in approaching behaviors (response) [Donovan et al. 1994]. The stimuli usually demonstrate in a variety of dimensions, such as external stimulus (e.g. website stimulus, marketing stimulus), internal stimulus (e.g. consumer characteristic), and situational stimuli (e.g. variety of selection) [Chan et al. 2017]. The Organism as a second component consists of the entire consumer process that intervenes between both stimuli and responses [Liu et al. 2013]. The last component is identified as the response, referred to, as approaching behavior. These behaviors are usually the positive actions in a particular environmental setting, including purchase behavior and online communication and unfavorable risk taking actions directed towards consumer choices [Chan et al. 2017]. The S-O-R framework is commonly used in online buying studies [Chan et al. 2017; Eroglu et al. 2003; Shen and Khalifa 2012].

From our live streaming commerce research context, it is clear that the S-O-R framework is appropriate for three key reasons. First, the S-O-R framework has been successfully applied in previous studies regarding online consumer behavior. Existing studies have consistently investigated the relationships between environmental stimuli, consumers' cognitive and emotional state and the consequential behaviors in an online retail context [Zhang et al. 2014]. Second, it provides a parsimonious and theoretically justified way to include different forms of environmental stimuli in an online commerce context, ranging from website content stimuli (e.g. the high quality of product information and the streamer's attractiveness), to social stimuli (e.g. social influence results from the social relationships developed) [Animesh et al. 2011; Zhang et al. 2014]. Third, it allows us to examine the viewer's cognitive and emotional states based on the environmental stimuli and their likely effects on resulting behavior. Within the live streaming commerce context, the viewer is stimulated by numerous environmental stimuli (e.g., streamer attractiveness, para-social interaction, and information quality), and the consequential shopping activity is undertaken by a stimulated consumer. The S-O-R premise is that stimulating cues, referred as stimuli, can trigger an individual's emotional and cognitive process (organism), resulting in approaching behaviors (response) [Donovan et al. 1994]. Therefore, this framework helps to explore what contextual cues influence a consumer's emotional and cognitive decision processes and how the contextual cues and decision processes affect consumer behavior.

### 2.2.1. Stimuli in live streaming commerce

As mentioned previously, streamers, play a key role in creating the critical content stimuli to engage viewers when connecting to a live streaming channel, such as relevant media content, environmental cues, sharing useful information, real time social interaction all delivered via a suitable consumer channel. By applying S-O-R to live streaming commerce, we identify the streamer's attractiveness, para-social interactions, and information quality to represent the stimuli within a live streaming commerce context that triggers the viewer's emotional and cognitive process.

In this study we define streamer attractiveness as the personality, appearance, and talent the viewers perceive regarding the streamer during a live stream [Ha and Lam 2017]. Viewers may find the streamer's personality attractive, for instance their sense of humor and hard-working attitude, their appearance attractive, and perceive the streamer to have talent in persuading people to buy products or to believe product information usefulness when making recommendations. An attractive streamer acts as a charming social actor that provides fantasy and pleasure to live streaming viewers, and stimulates their ongoing engagement. Hence, streamer attractiveness is an important content stimulus in a live streaming commerce context.

Para-social interaction is another stimulus and is defined as the viewer's subjective feelings of the interpersonal involvement and intimacy towards a live streamer [Schramm and Hartmann 2008]. Their presence in a live streaming environment is an important stimulus because it implies the viewer can have direct or indirect human contact with the streamer [Hassanein and Head 2007] and creates the feeling of being physically present in an artificially created virtual environment. The sense of para-social interaction can be triggered if streamers adapt their communication style, facial expressions and body language to create the illusion of two-way connection with their viewers [Dibble et al. 2016]. Consequently, triggered by the para-social interaction experience, live streaming viewers may believe the streamer is their intimate friend. Because the streamers often respond timely and nicely to viewers' comments and are attentive to viewers' watching experience and personal feelings this intimacy is cultivated [Hu et al. 2017]. In live streaming commerce, streamers react to viewers' questions, suggestions, and responses in real time. For example, streamers provide tips according to individual viewer's concerns, often performing spontaneously, such as making jokes or singing. Streamers may also share their own feelings on life and work with viewers. Hence, viewers naturally develop a sense of virtual connection and a perceived bond with the streamer [Hu et al. 2017]. Prior studies in traditional and online consumer research identified social factors as key stimuli, including dimensions of a salespersons' performance [Baker et al. 1992]. Live streaming commerce provides a range of opportunities for viewers to communicate and socialize with the streamer [Hu et al. 2017]. We argue that the para-social interaction facilitated via a virtual environment is an important stimulus throughout a live stream.

Live stream content has been widely identified as the contextual stimuli in S-O-R [Chan et al., 2017], such as the navigation [Ltfi 1970], media format [Adelaar et al. 2003], and website features [Parboteeah et al. 2009]. In live streaming commerce, product cues and merchandise images are represented and endorsed by streamers [Chen and Lin 2018]. We identify information quality as a key stimulus for viewer engagement, such as accurate product-related information (e.g. product features, price offers, and return policies) the reliability of the information content, and the immediacy of responding to viewer information requests. The quality of the information is a critical means for understanding whether the consumer's desire has been fulfilled [Kim and Stoel 2004].

Information quality in this study refers to the viewer's perception of the usefulness, reliability and completeness of the information provided in the live stream [Hilligoss and Rieh 2008]. Several facets are applied to judge information quality, such as completeness, accuracy, currency and reliability [Hilligoss and Rieh 2008]. Product information quality has been improved by the technological and non-technological facets in live streaming commerce. Prior literature indicated that the information media format (text, image, and video) is one of the most significant stimuli in S-O-R [Chan et al. 2017]. The live streaming commerce mechanism facilitates a simultaneous interaction channel where streamers can respond to viewers' inquiries about a product, and viewers can obtain information that he or she is interested in, in real time [Hilvert-Bruce et al. 2018; Sjöblom and Hamari 2017]. Thus, the live streaming commerce mechanism provides high quality product information as a critical stimulus to facilitate consumption decisions.

### 2.2.2. Organism in live streaming commerce

The S-O-R paradigm assumes that environments contain stimuli that cause changes to people's internal states, including cognitive state and emotional state [Eroglu et al. 2003]. Cognitive assimilation from stimuli refers to the mental processes occurring in an individual's mind when he or she interacts with the stimulus [Eroglu et al. 2003]. For example, it relates to how online consumers process product-related information presented on a website [Jiang et al. 2010]. While viewers are engaged in live streaming commerce, they are exposed to environmental cues, for example, they may frequently watch a streamer's performance that they perceive as being attractive, actively interacting with others while watching, and happily acquire information during the process. This seems a natural

experience for viewers to digest various kinds of information, consider the streamer's recommendations and develop a new understanding regarding a brand or product accordingly. We define cognitive assimilation as the extent to which viewers' existing thoughts, beliefs or attitudes are adjusted through the acquisition, assimilation and absorption of streamer influences [Piaget et al. 1989].

Emotional reactions capture emotional responses when individuals interact with an environment [Chan et al. 2017]. Some dimensions are parts of the emotional states, such as the high degree of intensity, arousal, excitement, and activation [Russell and Pratt 1980]. Mehrabian and Russell [1974] suggest arousal "as an affective property ranging from sleep to frantic excitement." There are numerous studies relying on the S-O-R framework and show that arousal is a prominent emotional state in determining the motivation to approach or avoid entering a consumption environment. The approaching behaviors include three important aspects: a desire to explore an environment, a motivation to communicate/interact with others, and a reported satisfaction with the shopping experience in the environment [Chan et al. 2017]. In this study, we define arousal as the degree to which a viewer feels stimulated, active, or inspired by the streamer during the live stream [Mehrabian and Russell 1974]. In a live streaming commerce context, numerous stimuli such as attractive streamers, high quality information, para-social interaction, and marketing strategies are utilized to fulfill viewer's needs or entertain and motivate viewers to feel excited about engaging in a variety of commercial activities.

### 2.2.3. Responses in live streaming commerce

As mentioned previously, in a live streaming commerce environment, viewers are attracted, generate interest and absorb product information and recommendation naturally and are often aroused and feel excited due to the highly interactive experience, the entertaining content, and novelty of shopping in it. Consequently, the cognitive and emotional states derived from these features provide a rich multitude of user experiences, and generate greater motivations to drive consumption and sharing behaviors. For instance, viewers may enjoy the entertainment of watching the streamer's performance, find the shopping process to be hedonic and full of entertainment, and may conduct unanticipated purchases. Viewers are usually very happy to share the product they bought and the shopping experience with their friends, and promote that streamer in their social networks.

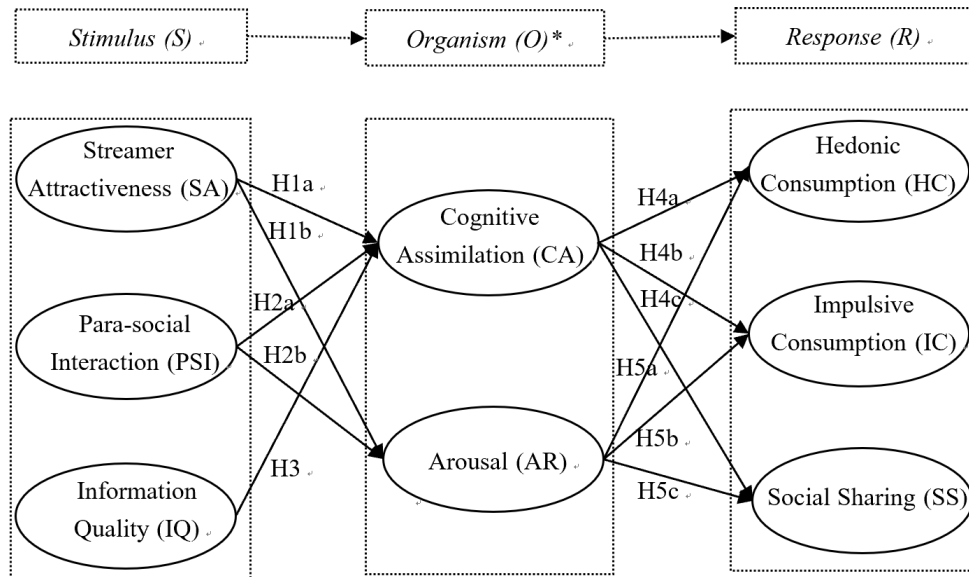
Applying S-O-R to live streaming commerce, we identify impulsive consumption, hedonic consumption, and social sharing as the consumer approaching behavior in live streaming commerce. Impulse buying covers a significant portion of retail turnover [Floh and Madlberger 2013], and has been defined as "a purchase that is unplanned, the result of an exposure to a stimulus, and decided on the spot" [Piron 1991]. With the popularity of e-commerce, impulse purchase is prevalent and found producing a large portion of online sales [Zhao et al. 2019]. E-commerce frees consumers from the constraints (e.g. variety of products and time limitation) that they might experience in brick-and-mortar stores, which in turn increases their tendency to conduct impulsive purchases [Chan et al. 2017]. Impulsive consumption is an important viewer's response in live streaming commerce; referred to as unanticipated purchases in a live streaming commerce context in this study. There are four types of impulse purchases: pure impulse buying, reminder impulse buying, suggestion impulse buying, and planned impulse buying [Stern 1962]. Consumers may be inclined to conduct pure impulse buying when they tend to break their normal purchase patterns and enjoy a novelty or escape purchase. Live streaming viewers may feel stimulated by novel and interesting products promoted by the streamer. Live streaming is commonly used as the show event for new product models. Live streaming commerce may also motivate reminder impulse buying when viewers see a product recommendation in a live stream. Viewers recall their prior satisfactory shopping experience with this product. Live streamers can also facilitate a viewer's suggestion for impulse buying as consumers first see an item and realize a need for it because the streamer usually presents comprehensive information on the product to viewers and suggests different occasions for using the product. Finally, planned impulsive buying often occurs in live streaming commerce because viewers may have a particular shopping list, but they conduct spontaneous purchase decisions for promotions and discounts offered by the live streamer matching their expectations.

Hedonic consumption in this study refers to the viewer's feeling of enjoyment through shopping via live streaming commerce. Researchers have advocated greater attention to investigate hedonic consumption and explore the factors motivating consumers to explore pleasure and enjoyment [Alba and Williams 2013; Hirschman and Holbrook 1982]. For some viewers, the seeking and acquisition of novel products, as well as, the entertaining experience of engaging in live streaming commerce, such as something different and interesting, are hedonic rewards, resulting from purchases [Hausman 2000]. Live streaming commerce enables consumers to feel comfortable buying products while enjoying entertainment, novelty and pleasant social communication. For example, viewers can experience the fun and novelty to co-create the content of the live stream with streamers [Sjöblom and Hamari 2017; Sjöblom et al. 2017; Zhao et al. 2018]. In addition, consumers make trade-offs between hedonic consumption and the resources necessary to procure it—namely, its price [Alba and Williams 2013]. Hence, viewers may also enjoy the hedonic benefits due to special offers provided during the live stream.

Social sharing is another important viewer response to live streaming commerce. This refers to a viewer’s live streaming experience sharing behavior through social networks. Social sharing is distinguished from traditional online reviews, since people mainly conduct social sharing to actively engage in the shared experience and information with their friends in the social networks, whereas traditional online reviews are presented to other unknown users [Liang et al. 2011]. Live streaming commerce provides convenient functionalities to facilitate social sharing behaviors. For instance, with a simple click, viewers can immediately stream the product information to their social networks with their own comments. Social sharing behavior includes sharing product review comments, a streamer, a stream, referrals and recommendations via a variety of social media [Bansal and Voyer 2000], such as forums embedded in the live streaming platform, WeChat, Facebook, Microblog, and other communities. Viewers may also get coupons, gifts and discounts from the streamer and the live streaming platform. The social sharing behavior is driven by the utilitarian benefits, and also the emotional and social benefits. The content shared in the social networks may become trending social topics among friends. For example, a viewer may share a stream that shows make-up tips and products on their own Facebook page. For individual consumers, information sharing behavior in social networks enhances interactions and provides information and knowledge [Tajvidi et al. 2018]. For brand or product managers, customers’ social sharing behavior has marketing significances, such as improving WOM, trendiness, customization and interaction [Godey et al. 2016].

2.3. Hypotheses and Research Model Development

We draw on the S-O-R framework to develop an explanatory model and a corresponding set of hypotheses. Figure 1 depicts the relationships between the identified dimensions. Based on the S-O-R framework and the relationships between the contextual and environmental stimuli, organism and responses in live streaming commerce, the model posits that three stimuli including streamer attractiveness (SA), para-social interaction (PSI) and information quality (IQ) affect both cognitive assimilation (CA) and arousal (AR), resulting in approaching behaviors, including hedonic consumption (HC), impulsive consumption (IC), and social sharing (SS) behavior. We further posit that cognitive assimilation and arousal mediate the relationships between the three stimuli and the three responses.



Note: \*: additional analysis is conducted to examine the mediating effect of organism

Figure 1: Research Model

2.3.1. The effects of streamer attractiveness on Organism

Streamers play the role as a representative or “endorser” of the product or brand in live streaming commerce. The endorsement effects work on the cognitive state and emotional state components rather than the behavioral components [Baker and Churchill 1977]. According to Singer [1983], likability is affection for the source, and a critical determinant of the message effectiveness. Consumers are inclined to build a positive stereotype towards the individuals attractive to them. Researchers suggested that attractive endorsers are more successful at changing consumers’ attitudes and beliefs regarding a product [Baker and Churchill 1977], facilitating purchase decisions and

participation behaviors than unattractive counterparts [Fireworker and Friedman 1977; Xu et al. 2017]. The work of Bergkvist and Zhou [2016] indicated that celebrity endorsements can exert positive impacts on people's good impression of a promoted item. Similarly, Chi et al. [2011] suggested that celebrity endorsements are able to increase a consumer's perception of product value, thereby facilitating their purchase decisions. Consequently, an attractive streamer may be very persuasive for viewers to accept his or her recommendation, absorb product information, and adjust their previous understanding and attitude accordingly. In addition, viewers may prolong the time and increase the frequency of engaging in watching a live stream, if they perceive the streamer to be attractive to them [Sjöblom and Hamari 2017]. This enhances the viewers' cognitive assimilation, due to the association between a brand and an attractive streamer. The following hypothesis is developed:

**H1a.** *Streamer attractiveness is positively associated with cognitive assimilation.*

Prior research has indicated that an endorser's attractiveness can increase arousal, and thus have a catalytic effect on information processing [Singer 1983]. The likeability and attractiveness make substantial contributions to the highly influential source effects [Baker and Churchill 1977]. In live streaming commerce, viewers may feel excited to see the attractive streamer, or feel exhilarated or surprised with the streamer's expertise. As previously described, the streamer's attractiveness has been identified as an important content stimulus in live streaming commerce and is a key element of an appealing stream, which can motivate the viewer's state of exhilaration and the elevation of emotion [Haidt 2000; Thayer 1990]. Hence, we propose the following hypothesis:

**H1b.** *Streamer attractiveness is positively associated with arousal.*

### 2.3.2. The para-social interaction effects on an Organism

People in para-social relationships believe the media personas are "real friends" and they indulge in experiencing a conformable and intimate relationship [Rubin and Perse 1987; Stern et al. 2007; Xiang et al. 2016]. In turn, this friendship-like relationship increases personal attachment, relationship investment, and loyalty toward media figures [Labrecque 2014; Xiang et al. 2016]. Strong social influences are generated during the para-social interaction process in live streaming commerce. Consequently, the streamer plays a critical role in the viewers' reference group, thus, the viewers' beliefs and cognitive state are assimilated according to the streamer's promotions. Adding social cues, enhancing social presence and facilitating para-social interaction with streamers, live streaming commerce creates a socially-friendly shopping context, leading viewers to believe that the streamer, product and other information provided is more reliable and less risky due to the developed para-social relationship [Hu et al. 2017]. Hence, para-social interaction in live streaming commerce allows viewers to naturally digest promotional information, adjust their prior beliefs and attitudes. We propose the following hypothesis:

**H2a** *Para-social interaction is positively associated with cognitive assimilation.*

Viewers with a strong sense of para-social interaction with the streamer will feel as if they are interacting with a close friend and warm social actor. Interactions with others are among the stimuli that affect energetic arousal [Haidt 2000; Metiu and Rothbard 2013; Thayer 1990]. Reeves and Nass [1996] suggested that adding technologies with stronger social features may "turn up the social volume", especially for the social features that can motivate more user engagement and involve more activities. This implies that viewers are more likely to feel aroused and emotionally satisfied when they develop a social relationship with a streamer who enables the viewers to experience a strong sense of social cues [Shen and Khalifa 2012]. Therefore, live streaming commerce using a streamer as a real social actor to "turn up the social volume", and evoke viewers' para-social interaction engagement. This in turn transforms the viewers' state of excitement and arousal. Prior studies have revealed that a friendly and sociable sales person has a positive influence on shoppers' emotional state, such as the interest and excitement in approaching behavior [Baker et al. 1992; Shen and Khalifa 2012]. Further studies indicate that viewers are inclined to be more emotionally attached to and identify with media personas that provide rich experiences of para-social interaction [Brown 2015; Frederick et al. 2012]. Thus, viewer para-social interactions with a streamer will be more likely to be emotionally involved and enthusiastically engaged. Hence, the following hypothesis is proposed:

**H2b** *Para-social interaction is positively associated with arousal.*

### 2.3.3. The information quality effects on an Organism

Information quality increases the customer's shopping experience satisfaction [Gao et al. 2012]. Information credibility and the perceived value of a product reduce the perceived risks, and enhance confidence in the transaction [Nicolaou et al. 2013]. This relates directly to the viewers newly transformed cognitive state and attitude. Information quality, such as the completeness, accuracy, currency and reliability, is perceived to be useful in live streaming commerce [Hilligoss and Rieh 2008]. Live streaming commerce provides high quality information with task relevant cues, such as, review comments, images, video, and sounds, detailed product presentations, real time interaction. Consequently, the information quality influences viewers to adjust or update their understanding of a product's perceived value. In addition, viewers can see how the product works in a variety of real-time contexts.



Therefore, the better the information quality perceived in live streaming commerce; the stronger cognitive assimilation is generated. The following hypothesis is proposed:

**H3.** *Information quality is positively associated with cognitive assimilation.*

2.3.4. The cognitive assimilation effects on hedonic consumption, impulsive consumption, and social sharing

Live streaming is entertaining in nature, with viewers able to recognize, absorb and understand interesting information, and enjoy the pleasant outcomes of consumption during the process. Cognitive assimilation may arouse the viewers' novel experiences in the live streaming commerce environment, which leads the viewer to obtain hedonic gratification from the consumption [Wang et al. 2017]. The cognitive assimilation process enables the viewers to understand the novelty and fun in having a product. In addition, many viewers are followers or fans of the streamer, they enjoy watching their performance and communicating with them in the live stream [Hu et al. 2017; Sjöblom and Hamari 2017; Zhao et al. 2018]. Hence, the cognitive assimilation process induces the viewers to believe that purchasing the recommended product can make them feel content and happy during the live stream, as the streamer provides immediate feedback, encourages purchases, and even perform as a thank you for their purchase. Live streaming commerce enables consumers to feel comfortable buying products while enjoying the entertainment, novelty and pleasant social communication. The following hypothesis is proposed:

**H4a.** *Cognitive assimilation is positively associated with hedonic consumption.*

In live streaming commerce, viewers are exposed to a variety of information facilitating their shopping decisions. In the cognitive assimilation process, viewers have developed a positive attitude and understandings towards the recommended product. Rook and Fisher [1995] indicated that consumers conduct impulse buying only when they feel the purchase decision is appropriate. Viewers make an evaluation or judgement of the appropriateness of making an impulse purchase based on their understanding and information obtained during the live stream. Hence, the cognitive assimilation process enables viewers to have a positive evaluation on impulse purchases and make them easily feel a sense of gratification. For example, watching the live stream, a viewer may be reminded of the need to buy a similar product, and the cognitive assimilation makes a viewer believe that the product recommended has all the merits and can satisfy their need. Offers and information during the live stream are typically available only for the live stream period and are not available at other times or on other channels. The cognitive assimilation allows the viewers to believe that the product has high value and is worth buying [Stern 1962]. Hence, viewers decide to take advantage of this knowledge, leading to more impulsive consumption behavior in a live streaming environment. The following hypothesis is proposed:

**H4b.** *Cognitive assimilation is positively associated with impulsive consumption.*

Social media are ideal tools for social sharing behaviors. Consumers can generate and spread live streaming related information to their friends, peers, and other acquaintances without constraints [Dolan et al. 2016; Vollmer and Precourt 2008]. Through the cognitive assimilation process, the viewers have already developed positive attitudes and beliefs towards a product, streamer and live stream. In addition, live streaming commerce platforms may evoke social sharing behavior by offering incentives, such as, coupons, discounts and time limited offers. Viewers may also be motivated to share products, streamers and live stream information across their social networks to enable friends to enjoy any live stream benefits. Viewers may obtain more social benefit through their social sharing behavior, since they can use live streaming commerce as social topics to interact with others in social networks, such as opinion seeking, opinion giving, opinion passing, and online forwarding which facilitates the flow of information in their social networks [Godey et al. 2016]. We argue that, the more a viewer adjusts their attitudes and beliefs to be in accordance with the information in the live stream, the more likely he or she is to share that information across their social networks. The following hypothesis is proposed:

**H4c.** *Cognitive assimilation is positively associated with social sharing.*

2.3.5. The arousal effects on hedonic consumption, impulsive consumption, and social sharing

According to the S-O-R framework, the level of emotion experienced by an individual will determine his/her approaching response. In a pleasant environment, arousal is the cause for approach behaviors [Shen and Khalifa 2012; Liao et al. 2016]. The approaching behaviors includes the desire to explore, communicate and report satisfaction in certain shopping environment [Donovan et al. 1994]. In the context of live streaming commerce, viewers explore the environment and conduct impulsive behavior, conduct hedonic consumption due to the novel and interesting shopping context, and they also enjoy interacting with others via the social sharing behavior due to the satisfactory shopping experience. Prior studies have revealed the relationship between arousal and shopping behavior, such as over-money spend behavior and the hedonic value of shopping [Wang et al. 2007], and the social interaction [Ridgway et al. 1990].

Arousal consumption behavior has been repeatedly verified in consumer studies [Chan et al. 2017]. Due to the entertaining nature of live streaming commerce, viewers may conduct hedonic buying. Specifically, live streaming has created a virtual environment for viewers to satisfy their needs for novelty, variety, and surprise [Chen and Lin

2018; Sjöblom and Hamari 2017]. Consumers can easily enjoy the multisensory, fantasy, and emotive aspects of one's experience with the shopping process [Liu et al. 2019]. Consequently, the feeling of psychological lift in the shopping environment may evoke the viewer to indulge in the hedonic buying atmosphere [Alba and Williams 2013]. Furthermore, viewers may enjoy the excitement evoked by a special offer, the opportunity to interact with attractive streamers, and the feeling of finding interesting and novel products in live streaming commerce contexts. The following hypothesis is developed:

**H5a.** *Arousal is positively associated with hedonic consumption.*

Similarly, ample evidence has indicated that the consumer's emotional state exerts a major influence on consumption behavior and decision making processes [Chan et al. 2017]. Individuals who are in a positive emotional state are more conducive to be impulsive or to overspend [Parboteeah et al. 2009]. Shen and Khalifa [2012] indicated that given a pleasant online shopping environment, consumers become highly aroused and are more inclined to spend more time, pay more attention, explore websites, and get involved with the product. The extended browsing and exploration may therefore induce impulse buying. In live streaming commerce, viewers are highly aroused by the environmental stimuli, such as the streamer's attractiveness, product information and social sharing. They are excited to engage in and explore the live streaming commerce environment, and that extended exploration may generate the desire for impulse buying. In addition, viewers also feel excited to take advantage of special offers limited to a live stream and conduct impulsive buying. The following hypothesis is developed:

**H5b.** *Arousal is positively associated with impulsive consumption.*

Emotions characterized by high arousal will boost sharing more than emotions characterized by low arousal [Gross and Levenson 1995]. Experiments have illustrated that arousal can offer plausible explanations regarding the spread of news and information in a variety of social settings [Peters et al. 2009]. Berger [2011] also demonstrated that the situations with heightened levels of both positive arousal (e.g., inaugurations) and negative arousal (e.g., panic), are able to enhance the social transmission of information. Moreover, Barasch and Berger [2014] indicate that emotions resulting from circumstances facilitate sharing activities. Emotional rewards may contribute to increasing social sharing behavior [Gross and Levenson 1995], similarly, viewers may achieve their goals in live streaming commerce (e.g. shopping, hedonic and social goals), and develop emotional arousal regarding the streamer, products, as well as the overall live stream experience through social sharing activities. Consequently, the viewers like to share their unique moments of engagement in live streaming commerce within their social networks. Hence, we argue that viewers with higher arousal are more inclined to conduct social sharing in the context of live streaming commerce. The following hypothesis is developed:

**H5c.** *Arousal is positively associated with social sharing.*

### 3. Research Design

#### 3.1. Measurement Development

In order to examine the research model hypothesis, a questionnaire was developed to conduct a web-based survey and collect empirical data. The items measuring each construct were mainly developed from previous literature. Some measures were slightly modified in order to suit the context of live streaming commerce context. We used a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree to measure all of these items.

Generally, the items for measure streamer attractiveness (SA) items were adapted from the work of Ha and Lam [2017]. We adopted the items from the research of Chen and Chang [2018] and Dong et al. [2014] to measure information quality (IQ). The measures for para-social interaction (PSI) were taken from Metiu and Rothbard [2013] and Rubin and Perse [1987]. The items for arousal (AR) and cognitive assimilation (CA) were modified from Mehrabian and Russell [1974] and the work of Beatty and Ferrell [1998] respectively. Similarly, we developed the items from Hausman [2000] to measure hedonic consumption (HC). Social sharing (SS) is modified from Galbreth et al. [2012] and Godey et al. [2016]. All the items for measuring the constructs are attached and shown in Appendix A.

For the purpose of improving the content validity of our questionnaire, we conducted expert interviews and a small-scale pilot test. Thirteen experts participated in the pilot test. Their responses were used to calculate the content validity ratios (CVR). The minimum criterion for CVR is 0.56 [Lawshe 1975]. The formula used to calculate CVR was proposed by Lawshe [1975]:  $CVR = (ne - N/2)/(N/2)$ . N is the total number of experts in the pilot test, and ne is the number of experts indicating the essentials of a specific item. This process resulted in minor revisions regarding item wording and suitability. Eventually, the questionnaire consisted of three parts, including motivation letter, background information and the instruments measuring the conceptual model constructs.

#### 3.2. Sampling and Data Collection

This study used the service of a popular web-survey website (<https://www.sojump.com/>) to collect empirical data in order to examine the research model. The website is a well-known e-commerce virtual community in China. The empirical data was collected between October 13th and October 27th, 2018. The participants with experience of watching online live streaming videos were invited to support this survey. Every respondent who completed the questionnaire was offered 5-10 RMB. In order to better motivate the respondents, we randomly selected around 20% of the respondents and provided free tickets as extra incentives (e.g. free membership of video, music and e-learning websites).

We explained the research motivation and ensured the confidentiality of respondents' information in the questionnaire. Attention check questions are adopted in the questionnaire, such as repeated questions and opposing questions (e.g. I have not watched the live streaming commerce websites (e.g., Taobao, Jindong, or Mogujie) in the past month or I did not interact with other viewers) to ensure the participant's live streaming commerce experience. If the participant answered "Yes" to these questions or did not provide complete answers to all the questions, the questionnaire is automatically eliminated. We chose the websites, such as Taobao.com, JD.com, and Mogujie.com, because these websites are the most well-known and largest e-commerce platforms to have launched live streaming functions in China. Prior studies examining Chinese live streaming commerce consumers have successfully adopted these e-commerce websites as well [Sun et al., 2019]. The live streaming channels on these e-commerce platforms are reputable platforms for brands to choose [Alizila, 2020]. For example, in certain industries (e.g. jewelry and plants), almost fifty percent of the sellers have used Taobao live streaming [AlibabaGroup 2019]. In addition, prior studies indicated that these e-commerce websites offer similar live streaming shopping functions and offer a standardized shopping process [Sun et al., 2019]. Shopping facilitation tools and shopping policies have naturally been integrated into these e-commerce platforms. Live streaming commerce streamers on other channels, such as social network sites (e.g. Facebook, Microbog) and specialized streaming platforms (e.g. gaming streaming and talent show streaming), eventually have to provide customers the links to their online stores on these e-commerce websites, since, other streaming channels usually do not host online shops. Quite often, the live streamers who are reputable on other streaming channels also provide streams on these e-commerce websites. Hence, this study mainly examines the customers who have experience of watching live streaming videos on e-commerce websites.

Of the 343 questionnaires collected, 300 are valid (87.5%) for further data analysis. The background information of the respondents is presented in Appendix B. Accordingly, 59% of the respondents are females, and 41% are males. This result is consistent with the prior studies investigating live streaming commerce [e.g., Sun et al., 2019; Wongkitrungrueng & Assarut 2018] and is also in accordance with prior studies in online retailing [e.g., Chen et al. 2015; Kim and Lennon 2013]. In addition, the results also indicate that 76.6% of the respondents are 20 to 34 years old. 52.6% of the respondents watch live streaming commerce 1 to 4 times a week and 44% of the respondents watch live streaming commerce for 0.5 to 1 hour each time.

#### 4. Data Analysis and Research Results

Structural equation modeling (SEM) is appropriate technique to analyze empirical data in confirmatory studies [Gefen et al. 2000]. As the second generation data analysis techniques [Chin 1998; Gefen et al. 2000], AMOS 25.0 was applied in this study to examine the measurement model and structural model by following the two-phase approach of confirmatory factor analysis (CFA) [Anderson and Gerbing 1988]. Following the approach, we are able to validate the reliability, validity and empirical data conformity in the measurement model, and estimate the statistical significance for path coefficients and level of significance of the hypotheses in structural model.

##### 4.1. Measurement Properties

In order to examine the adequacy of the measurement model, the reliability and validity analyses were performed. 1) First, this study examined the reliability and convergent validity. The instruments reliability was estimated by examining the composite reliability (CR) [Bagozzi and Yi 1988; Bearden et al. 1993]. The CR value should be above 0.7. The convergent validity is examined by factor load and Average Variance Explained (AVE) [Chin 1998; Fornell and Larcker 1981]. The factor loading of each item should be above 0.7 and AVE should exceed 0.5. The model included 32 items describing eight latent constructs: streamer attractiveness, para-social relationship, information quality, arousal, cognitive assimilation, impulsive consumption, hedonic consumption, and social sharing. As shown in Table 1 and Table 2, the factor loadings on their corresponding constructs are over the threshold of 0.7. Actually, all of the factor loadings are above 0.8 in this study. The composite reliability values of the constructs ranging from 0.9 to 0.94, are all over the thresholds of 0.7 [Straub 1989]. The AVE values ranging from 0.71 to 0.79, are all over the thresholds of 0.5. Hence, the results suggest a satisfactory convergent validity. 2) Second, the discriminant validity was assessed by evaluating square root of each AVE. The square root of each AVE should be greater than inter-construct correlations [Chin, 1998]. Accordingly, the results of Table 2 have shown that the discriminant validity of all constructs in the proposed research model can be assured.

Eventually, we examined the measurement model over all fit. The chi-square value normalized by degrees of freedom ( $\chi^2/df$ ) should be less than 3. The root mean square error of approximation (RMSEA) should not exceed 0.08 [Hair et al. 2010]. The normed fit index (NNFI) and comparative fit index (CFI) should exceed 0.9. Similarly, the value of adjusted goodness-of-fit index (AGFI) and goodness-of-fit index (GFI) should be larger than 0.8. For the current CFA model,  $\chi^2/df$  was 1.14, NNFI was 0.95, GFI was 0.91 CFI was 0.99, and RMSEA was 0.02. Consequently, these results indicate a satisfactory model fit.

Table 1: Descriptive Statistics for Constructs

Construct	Item	Factor loading	Composite reliability	Mean	AVE
Streamer Attractiveness (SA)	SA1	0.88	0.93	3.21	0.78
	SA2	0.90			
	SA3	0.84			
	SA4	0.87			
Para-social Interaction (PSI)	PSI1	0.87	0.91	3.20	0.74
	PSI2	0.88			
	PSI3	0.82			
	PSI4	0.88			
Information Quality (IQ)	IQ1	0.85	0.93	3.24	0.78
	IQ2	0.85			
	IQ3	0.86			
	IQ4	0.79			
Cognitive Assimilation (CA)	CA1	0.83	0.90	3.16	0.72
	CA2	0.86			
	CA3	0.83			
	CA4	0.78			
Arousal (AR)	EE1	0.89	0.90	3.16	0.71
	EE2	0.88			
	EE3	0.87			
	EE4	0.82			
Hedonic Consumption (HC)	HC1	0.89	0.93	3.22	0.78
	HC2	0.91			
	HC3	0.89			
	HC4	0.86			
Impulsive Consumption (IC)	IC1	0.85	0.91	3.13	0.72
	IC2	0.88			
	IC3	0.86			
	IC4	0.87			
Social Sharing (SS)	SS1	0.84	0.94	3.21	0.79
	SS2	0.90			
	SS3	0.89			
	SS4	0.89			

Table 2: Correlation among Constructs and the AVE Square Root

	SA	PSI	IQ	CA	AR	HC	IC	SS
SA	0.88							
PSI	0.34	0.86						
IQ	0.14	0.39	0.88					
CA	0.28	0.38	0.57	0.85				
AR	0.43	0.62	0.44	0.45	0.84			
HC	0.33	0.50	0.44	0.57	0.64	0.88		
IC	0.39	0.56	0.51	0.45	0.59	0.42	0.85	
SS	0.32	0.44	0.42	0.44	0.63	0.55	0.45	0.89

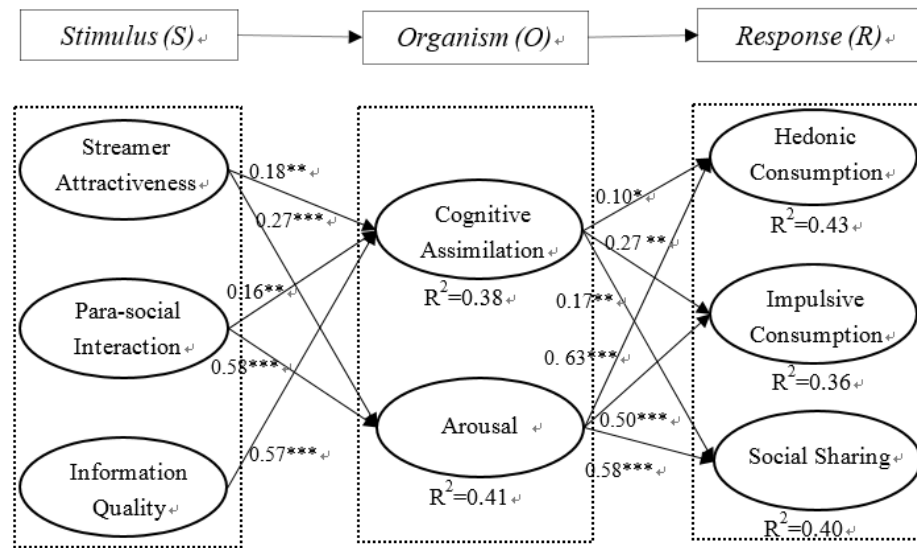
#### 4.2. Common Method Bias

Given the use of self-reported cross-sectional data, this study applied multiple tests to examine the potential common method bias (CMB). CMB refers to an issue that “variance is attributable to the measurement method rather than to the constructs the measures represent” [Podsakoff et al. 2003]. First, using principal components factor analysis, we applied Harmon's one-factor test in order to examine whether a single factor explains the majority of covariance. The results indicate that the first factor captures only 33.25% of the variance, which does not account for the majority of covariance. Hence, Harman’s suggested that CMB is not a problem in this study.

Secondly, we employed a technique by incorporating a common method factor in the research model. All of the construct indicators are used to measure the common method factor, in order to estimate the variance explained by substantive factors and the method factor [Podsakoff et al. 2003]. The results demonstrated that the substantive variance of the indicators is .65, while the variance of method factor is .031. The ratio of substantive variance to method variance was about 21:1. Similarly, the analysis results indicated common method bias should not be a serious problem in the study.

4.3. Structural Model

The hypotheses testing was conducted by using AMOS 25, to produce coefficients, statistical significance of the relationship, and the model fit index value for the research model. As shown in Fig 2, the hypotheses testing procedure produced the path coefficients, t-values, and explained endogenous variables’ variances (R<sup>2</sup>) for of each relationship proposed in the structural model. Figure 2 depicts that the explained variances for hedonic consumption, impulsive consumption, and social sharing are 43%, 36%, and 40% respectively. These values demonstrate that all of the factors in the research model are able to well explain the formation of the dependent variables. The significance and the path coefficients present further evidences to the nomological validity of the constructs in the conceptual model. In addition, as shown in Table 3, the model fit indices for the structural model were all at acceptable level. Thus, the fit of the overall model is fairly good.



Note: (\*: P < 0.05; \*\*: P < 0.01; \*\*\*: P < 0.001).

Figure 2: Structural Model

Table 3: Model Fit Indices for the Structural Model.

Model fit indices	Results	Recommended value	Model fit indices	Results	Recommended value
Chi-square statistic x2/df	1.39	< 3	RMSEA	0.036	<0.05
GFI	0.90	>0.8	NFI	0.93	>0.9
AGFI	0.89	>0.8	CFI	0.98	>0.9

As expected, all paths proposed in the research model are supported. In other words, the streamers’ attractiveness and para-social interaction are significantly and positively associated with cognitive assimilation and arousal. In other words, H1a ( $\beta = 0.18, p < 0.01$ ), H1b ( $\beta = 0.27, p < 0.001$ ) and H2a ( $\beta = 0.16, p < 0.01$ ), H2b ( $\beta = 0.58, p < 0.001$ ) are supported by the research results. And information quality is found to be significantly related to

cognitive assimilation, suggesting that H3 ( $\beta = 0.57, p < 0.001$ ) is supported as well. Moreover, cognitive assimilation and arousal are also found to be significantly related to impulsive consumption, hedonic consumption, and social sharing. The research results support the following hypotheses: H5a ( $\beta = 0.1, p < 0.05$ ), H5b ( $\beta = 0.27, p < 0.01$ ), H5c ( $\beta = 0.17, p < 0.01$ ), H6a ( $\beta = 0.63, p < 0.001$ ), H6b ( $\beta = 0.50, p < 0.001$ ), H6c ( $\beta = 0.58, p < 0.001$ ).

4.4. Additional Analysis---Mediating Effect of Organism

Previous studies applying the S-O-R framework in an electronic commerce context have found that an organism mediates the stimuli effects on its' responses [Chan et al. 2017]. However, it is still unclear whether the organism (cognitive state and emotional state) exerts a full or partial mediating effect in live streaming commerce. Hence, we conduct additional analysis to examine the mediating cognitive assimilation and arousal effects. In testing mediating effects, the bootstrapping approach is applied to estimate the standard error and potential biases of each path [MacKinnon 2008], and we set the generation of 1000 bootstrap samples as recommended [Changya and Wang 2010]. We examined total effects, direct effects, indirect, and two-tailed significance of the effects. The mediation effects are identified based on the significance of indirect effect, rather than the decrease in total effect or direct effect [Rucker et al. 2011]. Moreover, to conduct the mediation tests, the method uses the product-of-coefficients approach and by bootstrapping confidence intervals (CI) including bias-corrected to 95% CI and percentile 95% CI to test total, indirect and direct effects [Preacher and Hayes 2004]. In addition, since there are two mediators in the research model, this study also conducts the analysis to measure whether the mediating effects derived from these two mediators are significantly different. The data analysis results are shown in Appendix C.

The analysis results indicate that arousal exerts full mediating effects on the relationships between the (1) streamer's attractiveness to hedonic consumption and social sharing, and (2) para-social interaction to hedonic consumption and social sharing. Meanwhile, cognitive assimilation does not exert mediating effects on the above relationships. In addition, cognitive assimilation exerts full mediating effects on the information quality relationship to social sharing. Second, arousal exerts partial mediating effects on the streamer's attractiveness relationship to impulsive consumption. Cognitive assimilation exerts partial mediating effects on the information quality relationship to hedonic consumption and impulsive consumption. Table 4 summarizes the mediation effect results. These results suggest that environmental stimuli may influence impulse buying via the organism as S-O-R suggested, or entice the impulse buying directly. These results are in accordance with the S-O-R framework assumption.

Table 4: Summary of Mediation Effects.

Mediator	SA-HC	SA-IC	SA-SS	PSI-HC	PSI-IC	PSI-SS	IQ-HC	IQ-IC	IQ-SS
Arousal	Full	Partial	Full	Full	Partial	Full			
Cognitive assimilation	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	Partial	Partial	Full

Note: 1: Full: full mediation; 2: Partial: partial mediation; 3: n.s.: not significant

5. Discussion and Conclusion

This study was motivated by the need for a theoretical explanation of what factors influence consumer's emotional and cognitive decision processes and how these factors jointly affect live streaming commerce viewers' behaviors. Building on the S-O-R framework, we identified streamer attractiveness, para-social relationship, and information quality to represent the stimuli within a live streaming commerce context. Cognitive assimilation and arousal were identified as the viewer's cognitive state and emotional state, and impulsive consumption, hedonic consumption, and social sharing were identified as the consumer approaching behavior, in addition to providing a theoretical framework to investigate the relationships among these factors. Our empirical results reveal interesting findings. Overall, the results show support for our proposed research model and yield several interesting observations.

Streamer attractiveness, para-social relationship and information quality have direct effects on cognitive assimilation and arousal. These findings confirm that streamer attractiveness, para-social interaction, and information quality factors play a critical role in influencing the viewer's cognitive and emotional states. This finding is consistent with the empirical results of Brown [2015], Frederick et al. [2012] and Hu et al. [2017]. Among the three stimuli, para-social interaction exerts the most significant impact on arousal. The results correspond to prior studies indicating that viewers are inclined to be more emotionally attached to and identify with media personas that provide richer para-social interaction experience [Brown 2015; Frederick et al. 2012]. These findings shed light on the social feature of live streaming, suggesting that para-social interaction is a key atmosphere stimulus that can strongly influence the viewer's emotional state. In addition, information quality exerts the strongest influence on cognitive assimilation. While, the streamer attractiveness ( $\beta = 0.18^{**}$ ) and para-social interaction ( $\beta =$

0.16\*\*) effects on cognitive assimilation are smaller than information quality ( $\beta = 0.57^{***}$ ). This implies that information quality has a stronger effect on the viewer's cognitive state than the streamer's attractiveness and para-social interaction. The possible reason can be that high information quality is positively associated with low transaction risk, high trust towards a person, and the expected performance of the product [Nicolau et al. 2013]. Viewers are therefore more inclined to adjust their understanding regarding a transaction accordingly.

Second, cognitive assimilation and arousal have a direct effect on impulsive consumption, hedonic consumption, and social sharing, thus confirming that the viewer's cognitive and emotional states play a critical role in influencing the viewer's purchasing and social sharing behaviors. Cognitive assimilation has smaller effect size in influencing viewers' behaviors, such as hedonic consumption ( $\beta = 0.10^*$ ) and social sharing ( $\beta = 0.17^{**}$ ). Arousal exerts much stronger effects on the viewers' behavior than the cognitive state does. Numerous studies have indicated the significant influences of emotional state on a variety of behaviors (e.g. shopping and social behavior) [Chan et al. 2017]. The possible reason may be the dominant effect of emotional motivation on live streaming usage. For example, obtaining entertainment [Bruce et al. 2018], emotional, pleasant, or aesthetic experience [Sjöblom & Juho 2017] are identified as the critical factors influencing watching live streaming videos.

Third, the streamer attractiveness and para-social interaction effects on impulsive consumption, hedonic consumption, and social sharing were mediated by arousal. However, cognitive assimilation only has a role in the information quality effect on hedonic consumption, impulsive consumption and social sharing. These findings are consistent with the S-O-R notion, which contends that a stimulus affects an organism, and the organism influences the response. As shown in Table 4, arousal exerts full mediating effects on these relationships (1) streamer attractiveness to hedonic consumption and social sharing, and (2) para-social interaction to hedonic consumption and social sharing. The possible explanations can be as follows: Viewers mainly engage in live streaming commerce NOT to efficiently complete their shopping tasks [Cai et al. 2018]. Instead, viewers want to gratify emotional needs in the live streaming hours [Sjöblom et al. 2018], and their following behavior, especially for hedonic shopping, heavily rely on their "mood" activated during watching the live streaming. They like to be stimulated and enjoy the hedonic and entertainment process [Wongkitrungrueng and Assarut 2018], via an attractive streamer and the enjoyable para-social interactions with them [Hu et al. 2018], and engage in the strong exhilaration emotion in evoking motivation for further behaviors. They want to share their watching experience with their social networks when they feel excited, since it makes no sense to share something that cannot evoke their own feelings to their friends.

In addition, cognitive assimilation exerts full mediating effects on the information quality to social sharing relationship. The possible reason can be that viewers receive product information while watching live streaming commerce, and they may develop positive attitudes, such as trust towards some of the products or brands [Wongkitrungrueng and Assarut 2018]. They only share products after they sincerely believe the product is good for their social networks. For the second partial mediating case, the possible explanations can be as follows: (1) Viewers may have the urge or tendency to buy impulsively, which may drive viewers to directly conduct impulse buying when they are evoked by environmental stimuli [Liu et al. 2013]. (2) Another reason could be that viewers maybe fans of the streamers. They have developed long-term trust and experiences towards the streamer and the product she or he promotes [Wongkitrungrueng and Assarut 2018].

#### 5.1. Contribution to Research

Our study has three key theoretical contributions. Our first contribution to theoretical implication is related to our empirical results. The findings indicate how contextual factors influence the consumer's cognitive and emotional states, in turn influencing consumer behaviors in live streaming commerce contexts. Among the three stimuli, para-social interaction exerts the most significant impact on arousal and information quality exerts the strongest influence on cognitive assimilation. Prior studies focused mostly on the technological stimulus, special clues, or e-store designs in online consumption [Chan et al. 2017; Vieira 2013]. Other studies investigated the influence of para-social interaction on social behavior [e.g. Cohen and Tyler 2016; Hu et al. 2017; Labrecque 2014]. These findings shed light on the contextual and environmental stimuli including content clues and social relationship features of live streaming on consumer behavior in live streaming commerce, suggesting that para-social interaction as a key atmosphere stimulus that strongly influences the emotional state of viewers with information quality as an important stimulus that strongly affects the viewer's cognitive state.

Our second theoretical contribution is investigating both cognitive assimilation (cognitive state) and arousal (emotional state) as key drivers facilitating consumer behavior. The results indicate that arousal has a stronger impact than cognitive assimilation on consumer behavior, thus provides a richer understanding of the organism effect on response within S-O-R. Numerous studies indicated that emotional state (e.g. arousal, pleasure, affection) significantly influences a variety of behaviors (e.g. shopping and social behavior) [Chan et al. 2017]. This study provides statistical evidence to support that the emotional state exerts much stronger effects than a cognitive state

does in the live streaming commerce context. The possible reason behind this may be due to the dominant effect of emotional motivations on live streaming commerce engagement. For example, obtaining entertainment [Bruce et al., 2018], emotional, pleasant, or aesthetic experiences are identified as critical factors in influencing watching live streams [Sjöblom and Hamari 2017].

Finally, our third theoretical contribution is identifying that arousal plays a critical full mediating role on the streamer attractiveness and para-social interaction effects on hedonic consumption and social sharing and a partial mediating role on impulsive consumption. Cognitive assimilation only has a full mediating role on the information quality effect on social sharing and a partial mediating role on hedonic consumption and impulsive consumption. These findings broaden our understanding of the interplay between organism stimuli and responses.

Our findings provide a richer understanding of the causality within the S-O-R framework, enabling us to hypothesize the mechanisms through which streamer attractiveness, para-social interaction, and information quality can influence cognitive assimilation and arousal, and in turn, influence consumer behavior. Prior studies on live streaming focused mostly on the viewers' continued intention [Chen and Lin 2018; Hu et al. 2017], subscription behavior [Sjöblom and Hamari 2017], engagement [Hilvert-Bruce et al. 2018], and gift giving behavior [Yu et al. 2018]. This research contributes to the empirical literature examining how contextual and environmental stimuli and organism factors influence consumer behavior in a live streaming commerce context.

## 5.2. Practical Implication

Our results have several practical implications for live streaming commerce. Cognitive assimilation and the state of arousal directly influence impulsive consumption, hedonic consumption and social sharing behavior. For practitioners aiming to evoke viewers' impulsive consumption, hedonic consumption and social sharing behavior, live streaming commerce platform design should focus more on creating attractive content and enhancing the social functions that meet the viewers' needs [Hu et al. 2017; Sjöblom et al. 2017]. The platform manager should identify, recruit, and promote attractive streamers for viewers [Chen and Lin 2018], the platform manager should allocate more resources to the most popular streamers (e.g., KOLs, stars and Internet celebrities) to enhance their role in attracting viewers, persuading potential consumers to digest product information, evoking the consumers' excitement to conduct purchases. Meanwhile, the live streaming managers may even provide training to streamers according to the viewers' preferences for popular broadcasting styles, streamer personalities, appearances and specialties. Moreover, the platform manager should develop useful functions to assist the streamer in showing their attractiveness to viewers, such as cute emoji, music, image tools.

The results also suggest that platform managers need to develop critical live streaming mechanisms and advanced functions to enhance the perceived product information quality, especially to improve the perceived completeness, accuracy, currency and information reliability [Hilligoss and Rieh 2008]. For example, platform managers should provide a stable platform and ensure that viewers can clearly see product images and in real-time. Streamers should present complete product information, product use occasions and scenarios should be explained clearly to facilitate viewers understanding of the information and their product evaluation [Nicoilaou et al. 2013]. Marketing information should be explained clearly to viewers as well, such as instant discounts or exclusive offers to evoke the viewers' excitement for spontaneous purchases. Platform managers should increase interactivity by embedding a variety of interactive functions to support product related discussion [Lin et al. 2019], and facilitate viewers in obtaining product feedback synchronously from both streamers and viewers. The mechanism to provide good quality information should be well designed to help viewers absorb and adjust their attitude accordingly, and thus conduct consumption and other social behaviors.

Both the platform manager and streamers should enhance the para-social relationship between the streamer and viewers, enabling viewers to perceive the streamer as a reliable friend and develop a sense of closeness with each other. The para-social interaction experience can be facilitated by increasing the interaction between streamers and viewers. Platform providers should design more social functions in the live stream [Chen and Lin 2018], such as gifting [Yu et al. 2018] and more vivid real-time communication [Hu et al. 2017]. Streamers should create more interesting topics to interact with their viewers, and reply to viewers instantly [Hilvert-Bruce et al. 2018]. The platform strategy should be designed to provide incentives to both the streamer and viewer, such as special offers, coupons, and extra gifts designed for the most engaged viewers.

## 5.3. Limitations and Future Research Directions

As with prior studies, our research is not without its limitations. The first limitation is the data collection process. The empirical data was collected mainly from a popular web-survey website. The respondents were all from China. This data sample may restrict the generalizability of the results. Hence, any researcher should be cautious in applying these results to other cultural and economic contexts. Future research should endeavor to explore live streaming commerce in different national regions. In addition, cross national comparison may produce more comprehensive understanding and more broadly applicable results.



In addition, this study examined a research framework with selected construct and proposed relationships in a fast developing phenomenon. Future studies may investigate the factors that could show the uniqueness of live streaming commerce, or apply different theoretical perspectives, explore other determinants, moderators, and control variables to provide a more comprehensive understanding of live streaming commerce. For example, product category and gender may influence consumers' behaviors in both offline and online shopping environments. At present, taking Taobao as an example, the most popular product categories using live streaming are clothes, shoes, accessories, jewelry, make-up, and household goods, which attract more female viewers. With the rapid development of live streaming commerce, a variety of products categories are becoming more popular and attracting both female and male consumers. Hence, future research may examine the moderating effects of these moderators in the live streaming context. Future studies can also investigate factors from streamers' attributes and features, such as their interaction skills and promotional techniques. Many streamers attracted their fans from a loose social group. Future studies may investigate how the interactions among fans in these groups facilitate a variety of behaviors. Finally, we acknowledge that some independent variables have relatively low effect size on the dependent variable, such as H1a ( $\beta = 0.18$ ,  $p < 0.01$ ), H2a ( $\beta = 0.16$ ,  $p < 0.01$ ), and H5a ( $\beta = 0.1$ ,  $p < 0.05$ ). This study is an exploratory research in a novel context that still has not been fully investigated, thus, this study examined the proposed constructs and verifies their effects and significance levels. The relatively smaller effects provide potential for future studies to further examine the role of these constructs in live streaming commerce and other possible determinants.

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## Appendix

## Appendix A: Measurement of Construct.

Construct	Item	Scales
Streamer Attractiveness	SA1	I think that the live stream streamer is talented.
	SA2	I think that the streamer has an enjoyable live streaming style.
	SA3	I think that the streamer has an interesting personality.
	SA4	I think the streamer has an appealing appearance.
Information Quality	IQ1	I think the content provided by the streamer is reliable (such as product, brand, and use experience).
	IQ2	In the live stream, I think the content provided by the streamer is true.
	IQ3	The streamer provides real-time information to meet my needs in the live stream.
	IQ4	In the live stream, I think the content provided by the streamer is complete.
Para-social Interaction	PSI1	In the live stream, I feel as though the streamer and I are friends.
	PSI2	When I am watching the live stream, I feel a sense of we-ness (togetherness) with the streamer.
	PSI3	I feel as though the streamer cares about my responses during the live stream.
	PSI4	I feel the streamer is like an old friend.
Cognitive Assimilation	CA1	While watching the live stream, my existing understanding regarding products/services is likely to be influenced through streamer information.
	CA2	While watching the live stream, my current knowledge regarding products/brands is likely to be influenced by streamers.
	CA3	While watching the live stream, my perceived value of the product can be transformed by streamer environmental cues.
	CA4	While watching the live stream, my preference of the product can be changed by streamer interaction.
Arousal	AR1	I feel enthusiastic about taking action while watching the live stream (e.g. shopping or social sharing).
	AR2	I feel exhilarated to participate during the live stream.
	AR3	I feel energized to initiate a variety of behaviours (suggestions/responses) during the live stream.
	AR4	I feel excited about engaging with the live stream.
Hedonic Consumption	HC1	The novelty of the live streaming shopping experience is pleasurable.
	HC2	The live streaming shopping entertains me.
	HC3	Being involved in the live streaming shopping is a fun experience.
	HC4	The live streaming shopping gives me a real high.
Impulsive Consumption	IC1	While watching the live stream, I buy things that I had not intended to purchase.
	IC2	While watching the live stream, I often buy things spontaneously.
	IC3	While watching the live stream, I often buy things without thinking.
	IC4	While watching the live stream, I feel like buying more things than I need.
Social Sharing	SS1	I pass information on brands, products, services and streamers from live streams to my friends.
	SS2	I share live stream information on my social networks.
	SS3	I share my own experience of the live stream, the streamer, and product on my social networks.
	SS4	I share live stream related posts on my social networks.

Appendix B: Demographic information of the respondents.

Variable (N=300)	Classification	Frequency	Percentage
Gender	Male	123	41.0%
	Female	177	59.0%
Age	Less than 15	0	0
	15~19	24	8.0%
	20~24	82	27.3%
	25~29	75	25.0%
	30~34	73	24.3%
	35~40	28	9.3%
	Above 40	18	6%
Education Background	Middle school or less	7	3.3%
	High school/college	48	16.0%
	University	185	61.60%
	Graduate /post-graduate	60	20.0%
Frequency on live streaming commerce	At least once per day	60	20%
	5-6 times per week	39	13%
	3-4 times per week	79	26.3%
	1-2 times per week	79	26.3%
	Less than once per week	43	14.3%
Watch duration	Less than 30 minutes each time	67	22.3%
	30 minutes – 1 hour	132	44%
	1~2 hours	71	23.7%
	2~3 hours	19	6.3%
	more than 3 hours	11	3.7%
Experience on live streaming commerce	Less than 1 month	28	9.3%
	1~3 months	42	14%
	4~6 months	110	36.7%
	6~12 months	47	15.7%
	Above 1 year	73	24.3%

Appendix C: Mediation Effects.

Effects	Point estimation	SE	Z-value	Biased -corrected 95% CI (lower-upper)	Percentile 95% CI (lower-upper)	Results
SA->HC (SA->AR->HC; SA->CA->HC)						
Total Effects	0.210	0.064	3.281	0.084-0.338	0.086-0.341	full mediation;
Indirect Effects	0.135	0.041	3.293	0.056-0.214	0.062-0.22	
Direct Effects	0.075	0.060	1.250	-0.040-0.198	-0.042-0.198	
SA-AR-HC	0.142	0.370	0.384	0.078-0.225	0.142-0.07	mediating effect
SA-CA-HC	-0.007	0.140	-0.05	-0.04-0.016	-0.039-0.016	No mediating effect
Mediation difference comparison	0.149	0.380	0.392	0.078-0.232	0.149-0.075	significantly different
SA->IC (SA->AR->IC; SA->CA->IC)						
Total Effects	0.239	0.050	4.780	0.147-0.344	0.134-0.332	partial mediation;
Indirect Effects	0.071	0.026	2.731	0.128-0.132	0.027-0.128	
Direct Effects	0.168	0.053	3.170	0.066-0.275	0.061-0.267	
SA-AR-IC	0.061	0.023	2.652	0.026-0.118	0.025-0.111	mediating effect
SA-CA-IC	0.009	0.013	0.692	0.01-0.41	-0.012-0.037	No mediating effect
Mediation difference comparison	0.052	0.027	1.926	0.005-0.111	0.003-0.108	significantly different

SA->SS (SA->AR->SS; SA->CA->SS)						
Total Effects	0.202	0.061	3.311	0.085-0.331	0.083-0.328	full mediation;
Indirect Effects	0.156	0.038	4.105	0.088-0.234	0.087-0.231	
Direct Effects	0.051	0.066	0.773	-0.073-0.194	-0.079-0.182	
SA-AR-SS	0.141	0.037	3.811	0.077-0.226	0.073-0.216	mediating effect
SA-CA-SS	0.015	0.014	1.071	-0.004-0.49	-0.006-0.048	No mediating effect
Mediation difference comparison	0.127	0.041	3.098	0.052-0.127	0.046-0.209	significantly different
PSI->HC (PSI->AR->HC; PSI->CA->HC)						
Total Effects	0.397	0.064	6.203	0.265-0.520	0.266-0.521	full mediation;
Indirect Effects	0.263	0.043	6.116	0.185-0.360	0.178-0.352	
Direct Effects	0.134	0.073	1.836	-0.013-0.277	-0.008-0.282	
PSI-AR-HC	0.269	0.041	6.561	0.197-0.367	0.191-0.360	mediating effect
PSI-CA-HC	-0.006	0.012	-0.5	-0.035-0.15	-0.034-0.018	no mediating effect
Mediation difference comparison	0.275	0.042	6.548	0.210-0.372	0.195-0.367	significantly different
PSI->IC (PSI->AR->IC; PSI->CA->IC)						
Total Effects	0.381	0.059	6.458	0.262-0.489	0.262-0.490	partial mediation;
Indirect Effects	0.125	0.037	3.378	0.054-0.202	0.06-0.206	
Direct Effects	0.256	0.071	3.606	0.116-0.393	0.113-0.385	
PSI-AR-IC	0.116	0.036	3.222	0.0052-0.192	0.052-0.192	mediating effect
PSI-CA-IC	0.008	0.012	0.667	-0.009-0.39	-0.01-0.035	no mediating effect
Mediation difference comparison	0.108	0.039	2.769	0.040-0.189	0.041-0.190	significantly different
PSI->SS (PSI->AR->SS; PSI->CA->SS)						
Total Effects	0.297	0.660	0.450	0.173-0.433	0.168-0.426	Full Mediation;
Indirect Effects	0.267	0.044	6.068	0.195-0.363	0.194-0.366	
Direct Effects	0.020	0.071	0.282	-0.121-0.164	-0.123-0.162	
PSI-AR-SS	0.263	0.043	6.116	0.188-0.358	0.185-0.355	mediating effect
PSI-CA-SS	0.013	0.013	1.000	-0.006-0.47	-0.007-0.43	No mediating effect
Mediation difference comparison	0.250	0.046	5.435	0.169-0.356	0.160-0.347	significantly different
IQ->HC (IQ->CA->HC)						
Total Effects	0.375	0.079	4.747	0.225-0.540	0.220-0.541	Partial Mediation;
Indirect Effects	0.137	0.068	2.015	0.015-0.295	0.008-0.268	
Direct Effects	0.238	0.010	23.800	0.031-0.423	0.053-0.437	
IQ->IC (IQ->CA->IC)						
Total Effects	0.413	0.064	6.453	0.295-0.548	0.288-0.541	Partial Mediation;
Indirect Effects	0.105	0.052	2.019	0.011-0.215	0.008-0.209	
Direct Effects 8b	0.309	0.082	3.768	0.141-0.457	0.141-0.457	
IQ->SS (IQ->CA->SS)						
Total Effects	0.365	0.720	0.507	0.229-0.514	0.228-0.510	Full Mediation;
Indirect Effects	0.213	0.063	3.381	0.101-0.347	0.101-0.347	
Direct Effects	0.152	0.083	1.831	-0.007-0.323	-0.10-0.319	