## Editor-in-Chief

**Dr. Inna Reddy Edara**  
Fu Jen Catholic University, Taiwan

## Editorial Board Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jerwen Jou</td>
<td>United States</td>
</tr>
<tr>
<td>Raul Valverde</td>
<td>Canada</td>
</tr>
<tr>
<td>Yan Liu</td>
<td>United States</td>
</tr>
<tr>
<td>Leyla Akoury Dirani</td>
<td>Lebanon</td>
</tr>
<tr>
<td>Rosa Hendijani</td>
<td>Iran</td>
</tr>
<tr>
<td>Maritza Caicedo</td>
<td>Mexico</td>
</tr>
<tr>
<td>Hafizi Muhamad Ali</td>
<td>Saudi Arabia</td>
</tr>
<tr>
<td>Alla Vladimirovna Toropova</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>Warhel Asim Mohammed</td>
<td>Iraq</td>
</tr>
<tr>
<td>Dindar Shamsadin Bari</td>
<td>Iraq</td>
</tr>
<tr>
<td>Mehmet Cetin</td>
<td>Turkey</td>
</tr>
<tr>
<td>Suriyadeo Tripathi</td>
<td>Thailand</td>
</tr>
<tr>
<td>Mohammed Talib Alkiyumi</td>
<td>Oman</td>
</tr>
<tr>
<td>Prathyusha Sanagavarapu</td>
<td>Australia</td>
</tr>
<tr>
<td>Prisca Obierefu</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Kanimozhi Selvi C.S.</td>
<td>India</td>
</tr>
<tr>
<td>Liang Yu</td>
<td>China</td>
</tr>
<tr>
<td>Ramazan Biçer</td>
<td>Turkey</td>
</tr>
<tr>
<td>Vasiyye Geckin</td>
<td>Turkey</td>
</tr>
<tr>
<td>KyuJin Shim</td>
<td>Australia</td>
</tr>
<tr>
<td>Ai Ni Teoh</td>
<td>Singapore</td>
</tr>
<tr>
<td>Xiaoyan Xu</td>
<td>China</td>
</tr>
<tr>
<td>Bing-Bing Cao</td>
<td>China</td>
</tr>
<tr>
<td>Bing Jiang</td>
<td>United States</td>
</tr>
<tr>
<td>Michael Canute Lambert</td>
<td>United States</td>
</tr>
<tr>
<td>Catarina Iria</td>
<td>Portugal</td>
</tr>
<tr>
<td>Amira Dahmani</td>
<td>Tunisia</td>
</tr>
<tr>
<td>Ciara Toireasa Staanton</td>
<td>Ireland</td>
</tr>
<tr>
<td>Mar Durán</td>
<td>Spain</td>
</tr>
<tr>
<td>Manuel Ojea Rúa</td>
<td>Spain</td>
</tr>
<tr>
<td>Mark Pettigrew</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Anastasia Aldelina Lijadi</td>
<td>Austria</td>
</tr>
<tr>
<td>Luigi De Gennaro</td>
<td>Italy</td>
</tr>
<tr>
<td>Te Ma</td>
<td>China</td>
</tr>
<tr>
<td>Richard E. Vatz</td>
<td>United States</td>
</tr>
<tr>
<td>Elżbieta Szymańska</td>
<td>Poland</td>
</tr>
<tr>
<td>Laura Alho</td>
<td>Portugal</td>
</tr>
<tr>
<td>Eduard Balashov</td>
<td>Ukraine</td>
</tr>
<tr>
<td>Veronika Viktorovna Katermina</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>Jing Lu</td>
<td>China</td>
</tr>
<tr>
<td>Marco De Risi</td>
<td>Italy</td>
</tr>
<tr>
<td>Hung-Ming Lin</td>
<td>China</td>
</tr>
<tr>
<td>JaeHwan Kwon</td>
<td>United States</td>
</tr>
<tr>
<td>Sylvie Studente</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Yong Tang</td>
<td>China</td>
</tr>
<tr>
<td>Pavel Aleksandrovich Kislyakov</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>Kirk Chang</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Bilal Afsar</td>
<td>Pakistan</td>
</tr>
<tr>
<td>Cindy Anne Branch-Smith</td>
<td>Australia</td>
</tr>
<tr>
<td>Soohyun Yi</td>
<td>United States</td>
</tr>
<tr>
<td>Jo-Anne Botha</td>
<td>South Africa</td>
</tr>
<tr>
<td>Lars de Vroege</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Zeshui Xu</td>
<td>China</td>
</tr>
<tr>
<td>Bo Liu</td>
<td>China</td>
</tr>
<tr>
<td>Jing Han</td>
<td>United States</td>
</tr>
<tr>
<td>Solana Magali Salessi</td>
<td>Argentina</td>
</tr>
<tr>
<td>Kudakwashe Christopher Muchena</td>
<td>Zimbabwe</td>
</tr>
<tr>
<td>Casandra Isabel Monoro Aguilar</td>
<td>Spain</td>
</tr>
<tr>
<td>Utku Beyazit</td>
<td>Turkey</td>
</tr>
<tr>
<td>Amaryllis Chryssi Malegiannaki</td>
<td>Greece</td>
</tr>
<tr>
<td>Hassan Banaruee</td>
<td>Iran</td>
</tr>
<tr>
<td>Jamie Lee Jensen</td>
<td>United States</td>
</tr>
<tr>
<td>Francisco Javier Zarza-Alzugaray</td>
<td>Spain</td>
</tr>
<tr>
<td>Eghosa Noel Ekhaese</td>
<td>Nigeria</td>
</tr>
</tbody>
</table>
Contents

ARTICLE
1 Creating Space for Children’s Voices: Utility of the Collage Life Story Elicitation Technique
   Gertina J. Van Schalkwyk, Anastasia Aldelina Lijadi
31 Do Stress and Anxiety Impact Memory? An Exploratory Portuguese Study
   Laura Alho, Pedro F. S. Rodrigues, Cátia Fidalgo
43 Differences on Information Commitments in Consumption Domain
   Hung-Ming Lin

REVIEW
12 Behavioral Operations Management: A Review of the Field
   Veronika Katermina, Tatyana Safronova
39 Analysis of the Concept and the Drama Psychology of Immersive Theatre
   Xinyue Wang

Copyright

Journal of Psychological Research is licensed under a Creative Commons-Non-Commercial 4.0 International Copyright (CC BY- NC4.0). Readers shall have the right to copy and distribute articles in this journal in any form in any medium, and may also modify, convert or create on the basis of articles. In sharing and using articles in this journal, the user must indicate the author and source, and mark the changes made in articles. Copyright © BILINGUAL PUBLISHING CO. All Rights Reserved.
Creating Space for Children’s Voices: Utility of the Collage Life Story Elicitation Technique

Gertina J. Van Schalkwyk1  Anastasia Aldelina Lijadi2

1.University of Macau, Macau, China
2.International Institute for Applied systems Analysis, Austria

ARTICLE INFO

Article history
Received: 4 March 2019
Accepted: 15 August 2019
Published Online: 30 October 2019

Keywords:
Autobiographical memories
Children’s narrative
Collage Life-story Elicitation Technique

ABSTRACT

A challenge for many School-Based Family Counseling (SBFC) practitioners, child psychotherapists and researchers are finding ways to give voice to children and eliciting trustworthy and detailed narratives that could serve as resource for understanding the needs of young clients in the context of all their interpersonal networks. Children are often reticent when asked to self-disclose and tell their stories during consultation. The purpose of the present study was to examine the utility of five sequential steps constituting the Collage Life Story Elicitation Technique (CLET) for scaffolding storytelling among children in middle childhood (aged 9-12 years). Using the CLET for data collection and conducting an interpretive analysis, the researchers explored the performance of 38 middle-childhood children living in three different settings. Findings suggest that the five sequential steps of the CLET adequately and satisfactorily combine to stimulate and elicit rich data and help children to construct their narratives and represent the challenges they face in everyday living. We discuss the application of CLET in SBFC practice as tool when screening and intervention planning for children’s perspectives pertaining to a range of topics regarding each of the four quadrants as proposed in the SBFC metamodel.

1. Introduction

A challenge for researchers and those working with children in different settings (e.g., School Based Family Counselling (SBFC) practitioners, counsellors and therapists) is to find ways to create space for the stories that could reveal how the child makes sense of her or his experiences in the past in the present. At the young age of middle childhood, children still struggle to produce a coherent story[1]. and creating space for children’s voices is particularly relevant when working with children in settings where language, societal discourses and/or local customs pose obstacles to the child’s ability to narrate her or his story. There are cultural differences evidence in giving voice to children using narrative elaboration, in which “Western societies typically promote independently oriented self-construal…Eastern cultures tend to espouse an interdependently oriented self-construal, emphasizing instead the relative importance of others in evaluating one’s own position in society” (p. 702)[2]. Nonetheless, in narrative approaches to research and counselling, we search for ways in which to elicit storytelling. Storytelling assists people (and children) to make sense of their lives and their lived experiences, and in

*Corresponding Author:
Anastasia Aldelina Lijadi,
International Institute of Applied System Analysis, Austria;
E-mail: lijadi@iiasa.ac.at
there narratives children summarise their beliefs, customs, norms, symbolic actions and interactions as representations of how they develop through life.

The Collage Life story Elicitation Technique (CLET) is a visual arts-based research method, which incorporating a semi-structured interview procedure that unfolds in five sequential steps each building upon the other. In this paper, we aim to build a viable case regarding the CLET as innovative technique for conducting narrative research and counselling based on social constructional theory and symbolic interactionism. The purpose of the current study was to examine the utility of the CLET and to describe the use of visual scaffolding through collage-making in three different cultures in stimulating autobiographical remembering and storytelling narrative accounts of children aged 9 to 12 years. The central question of the study was: how do the five steps of the CLET combine to elicit rich narratives from children in middle childhood?

2. Literature Review

The processes of learning to narrate and constructing stories of specific life experiences are influenced by the interaction with social partners. Storytelling is a way in which people make sense of their lives and translate knowing into telling. Parents or caregivers provide the scaffold for the child’s narratives by asking questions and giving comments, thereby helping the child produce narratives with more complex structures. As they grow up, children interact with their parents as well as the social environment to develop narrative skills and cognitive capacities. Being able to recall and organise their memories help children, for example, to establish domain-general cognitive capacities that form the basis for other domain-specific abilities such as causality and intentionality. Children in middle childhood, however, are not yet fully storied posing obstacles to their verbalisation of underlying challenges often hidden from direct observation; others lack the discursive modes of expression, while some cultural conventions also preclude self-disclosure. Although researchers have used traditional approaches to elicit children’s stories, the current study aimed to find a new way to create space for children’s narrative representations, particularly for those children who need some form of stimulation for their verbalisation.

The social constructionist approach and symbolic interactionism formed the theoretical framework for developing the Collage Life-story Elicitation Technique (CLET) as an innovative way to open up a space for children’s narratives. The CLET makes use of both non-verbal (collage making) and verbal (storytelling) modes of representation. According to social constructionism, language—also non-verbal languages—is a social action in which people construct/create a subjective reality of the world in which they live through their explanations, descriptions and performances of experiences and perceptions. The symbolic interactionism adopts the notion that people act and interact with the environment based on the meanings that the environment have for them. These meanings result from interactions with others, specifically significant others, social discourses, and culture-specific artefacts, and are often stored in memories that are not easily accessible. Visual images or artefacts are a form of language, and can be combined in a collage to create a non-verbal representation of reality as perceived and experienced by the child. The creator of the collage is telling a story by combining images from culture-specific sources such as magazines providing an expression of the understanding and meanings of their lived experiences.

The visual research methods are becoming useful modes for working with children. Particularly when exploring challenging topics, collage making has been identified as beneficial to overcome the challenge of language and expression when working with children. Visual research methods rely on projective and representational techniques that enable the participant to engage with and process subconscious meanings of remembered events. Arts-based research assists the SBFC practitioner gaining access to personalised accounts of the participant’s experiences in the past and how these might influence the future. By incorporating some form of graphic communication instead of just talking, collage making aims to serve as a scaffold for children’s memories and directs attention inward to what they believe or feel and remember about their experiences. Creating a collage from locally relevant and cultural resources such as magazines also provides for a discursive co-narrator or conversation partner or audience allowing the storyteller to construct visual and non-verbal narratives, and bring to awareness the intra-personal materials often more difficult to access through merely verbal means and answering questions posed by an interviewer.

3. Method

In this project examining the viability of the CLET to create space for children’s voices, we employed a case study design to explore the central question of how the five steps of the CLET combine to elicit rich narratives from children in middle childhood (aged 9 to 12 years). We assumed that the children in each of these settings could select images for collage making that would appropriately represent the topic under investigation to support the propositions regarding the usefulness of the CLET creating space for the children’s voices to be heard. Furthermore, we assumed that the positive participatory process embedded in the CLET would
assist the child with representational performance of a full and realistic range of memories about the topic under investigation. Following the replication logic for multiple-case studies and based on the premise that the CLET would provide the same units of analysis, the CLET procedures were implemented in three different settings. The three regional settings included Macao (a former Portuguese colony and now a Special Administrative Region of China), Zhuhai (a major city on the south-east coast of China), and Gaborone (the capital of Botswana). Fieldworkers and research assistants in each of the settings assisted with the data collection. Prior to collecting the data, the fieldworkers were trained by the principle investigator (first author) to implement the procedures of the CLET in a semi-structured interview and were provided with a comprehensive guide for conducting the fieldwork.

3.1 Participants

Participants for this study were recruited through non-probability convenience sampling [24] by the fieldworkers who were themselves local citizens and who were introduced to the participant by relatives or friends. The inclusion criteria in all the settings were the same, namely children, both boys and girls, in middle childhood (aged 9-12 years), and with no obvious or diagnosed evidence of a psychological disorder (e.g., learning disability or physical impairment). The fieldworkers in recruited altogether 52 child participants in the three settings. However, 14 participants had to be excluded because they either did not fit the age criterion or did not sufficiently complete the CLET, the latter because of the fieldworker’s inability to follow procedures rather than the child participant choosing to withdraw. This resulted in 38 participants (73%) for this study ($N_{\text{Macao}} = 18$, $N_{\text{Zhuhai}} = 14$, and $N_{\text{Gaborone}} = 6$) who voluntarily collaborated with the fieldworkers for completing the CLET.

1. In the Macao setting, five girls and 13 boys participated ($M_{age} = 10.06$, age range: 9 to 12 years); the children were from either single parent or two-parent families, and 10 were the only child in the family.

2. In Zhuhai, seven boys and seven girls participated ($M_{age} = 9.29$, age range: 9 to 10 years); nine of these participants were single children, and except for one child, all others came from two-parent families.

3. The Gaborone (Botswana) cases included two boys and four girls ($M_{age} = 10.83$, age range: 10 to 12 years), and all except one had multiple siblings. The single child in this setting was also the only participant from single-parent family.

Since the children were all under the age of 18 years, their parents’ consent was solicited prior to conducting the CLET interviews. Parents received information (in English or Chinese) about the purpose and content of their child’s participation and signed the informed consent allowing the fieldworker to audio record the ensuing interview and for the textual data to be used for research purposes. The children participated voluntarily and with no coercion, themselves giving verbal assent for their participation [25]. All records were archived electronically in a password-protected file. No personal or identifying information of the child and/or their family members was recorded and reported below.

3.2 Data Collection

The authors used data collected by fieldworkers in each of the three settings mentioned above. The principal investigator (first author) recruited volunteer fieldworkers and trained them to collect the CLET data following procedures [26]. The fieldworkers for the Macao and Zhuhai settings were students at a local university who completed the data collection as part of a classroom assignment in a developmental psychology course. In the Gaborone setting, a fieldworker from the local university volunteered and was trained to conduct the CLET interviews. In each setting the instructions for the five steps of the CLET were posed in the child’s native or preferred language. The fieldworkers in Macao and Zhuhai conducted the interviews in Cantonese and Putonghua, the respective native languages of the children in these two settings. In Gaborone, the fieldworker conducted the interviews in English, the language preferred by the children in this setting despite their native language being SeTswana. Gaborone children are bilingual, learn English from an early age, and usually attend English-speaking schools to improve their proficiency in the second language [27][28].

The average interview time for completing all the steps in the CLET with the children was approximately 60-70 minutes, with the first 20-25 minutes for collage making (Step 1) and ±35-40 minutes (or more if necessary) for eliciting the narratives (Steps 2-5). The focus topic for the CLET in all the settings was the children’s perceptions and recollections of family life. Although we conducted the CLET with this topic (i.e., family life) it was not for the purpose of examining the children’s perceptions regarding their families. Rather, the topic was selected to guide the procedures for completing the CLET and for the purpose of examining our assumptions related to the utility of the CLET to create space for children’s voices. Thus, the child participant was asked to make a collage about their memories of significant events or experiences (positive and negative) in the family (CLET Step 1) selecting images from locally resourced magazines and pasting these on A3 paper provided. Scissors and glue were available to
the child for convenience of executing the collage making. Each child was presented with a range of magazines (i.e., 6-8 magazines) including children’s magazines with images of cartoons and animations, and life magazines with images of food, travelling, technology, household items, sport, and fashion and clothing, all freely available within the local settings.

After completing a collage about the focus topic, the participants engaged actively in constructing stories for each of the images on the collage (CLET Step 2). Three prompts guided the storytelling phase, namely (1) “tell a story about this image,” (2) “what does this image mean to you,” and (3) “how does the image relate to the topic.” In CLET Step 3, the fieldworkers asked the participant (1) to position themselves in the collage (i.e., “where on the collage would you post a picture of yourself”), and (2) to reflect upon missing image (i.e., “what image would you like to add but could not find when making the collage”). The fieldworkers prompted for the thoughts and feelings about the self-positioning and missing image asking further questions as needed. Next (CLET Step 4) the participant reflected upon similar and different images in order to explore their interpretation of potential challenges embedded in the storytelling about the topic. CLET Step 5 concluded the interview engaging the participant in a final reflection and debriefing, also prompting the participant to add further stories should he/she wish to do so.

3.3 Data Analysis

Since this study used data collected by several fieldworkers, the first step in the analysis was to review the collected protocols to ensure comprehensiveness and completeness of each case. As indicated above, fieldworkers collected the CLET data, but some fieldworkers did not follow the procedures carefully and the initial review resulted in the elimination of incomplete cases. The authors examined the 52 protocols from the initial data set for the three settings carefully and selected the 38 protocols deemed representative of all or most of the five sequential steps of the CLET. To ensure confidentiality of both participants and fieldworkers, all names were changed to pseudonyms for further discussion.

The main objective of this project was to find evidence and justification for the proposition that the CLET is a useful method to elicit vivid memories and rich storytelling from children aged 9-12 years. As is common in qualitative research methods, this required an iterative and interpretive stance for pattern matching, explanation building and cross-case synthesis [16,29]. The CLET is not a diagnostic tool and thus, we did not test the psychometric properties for such purpose. Rather, we focused on providing thick descriptions of the children’s participation in the CLET so as to explore the utility for further use in research and child counselling.

After the initial review of all the protocols, we independently analysed the completed protocols for the three settings separately. We first analysed the collage (CLET Step 1) independent from the storytelling, and coded each collage in terms of the (1) nature and symbolic content of the images, and (2) the overall construction of the collage. Calculating the percentage of images per collage with a human-like content vs. an object-related content, we interpreted a higher percentage (>50%) of human-like images as the child’s ability selecting images representative of the focus topic (i.e., the family). Secondly, we analysed and coded the micro-narratives of the stories that the child presented for each image on the collage (CLET Step 2) examining the range of memories and the construction and coherence of these stories with the topic under investigation. We also noted the self-positioning and missing (CLET Step 3), and the reasoning related to similarities and differences (CLET Step 4) further examining whether the child could present vivid stories of their lived experiences when prompted with the CLET procedures. Self-positioning on the collage and the reasons for this position (narratives) represented the child’s authenticity as central character in their stories and the underlying perception of self-in-the-world and self-to-other/family relationships. Juxtaposing similar images with different images on the collage provided insights regarding the child’s range of memories and experiences of relationships within the family. Finally, we conducted a cross-case analysis comparing the protocols for the three setting separately before examining all cases across settings in order to provide justification for the utility of the CLET with children in middle childhood.

The analysis and interpretations of the CLET case materials evolved with the authors independently and rigorously reading the field texts and maintaining a reflective posture to limit potential biases [30]. Throughout the analytic process, we adopted a critical reflective position analysing the cases, and crisscrossing interpretations with the original collage and textual materials. Cross-case synthesis in each setting was performed to explore global, local and thematic coherence that emerged, and to build a credible case in support of the propositions regarding the utility of the CLET when used with children aged 9 to 12 years. Thematic coherence emerged from noting the repeated and grounded nature of emerging themes (both visual and verbal). To establish credibility and confirmability of the interpretations [31] the authors regularly discussed their analyses and interpretations. When discrepancies occurred, we resolved these going over the rationale for our respective decisions, re-reading the protocols, and refining the analytic process.
until we reached consensus about disputed or unclear items. There were no items in the final analysis and interpretation upon which the two authors could not come to an agreement. Thick descriptions, referring to information regarding the research settings, the collage, and different perspectives from participants, further added to a better understanding of the usefulness of the CLET as tool for creating space for children to narrate their perceptions and tell their stories. Below we present the findings and wherever feasible, include examples of the units of analysis to support validity and credibility of the CLET as a tool giving voice to children.

4. Comparing Performances on the CLET

Testing the utility of the CLET, we present the findings below comparing the performances of 38 children aged 9 to 12 years in three settings—that is, in Macao (n=18) and Zhuhai (n=14) and in Gaborone (n=6)—and testing the assumption that children in middle childhood would find it easy to follow the procedures when the CLET was conducted as a semi-structured face-to-face individual interview (Table 1).

Table 1. Comparison on the completion of 5 steps in CLET

<table>
<thead>
<tr>
<th></th>
<th>Macao n = 18</th>
<th>Zhuhai n = 14</th>
<th>Gaborone n = 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average number of images</td>
<td>12.50 (range: 9-16)</td>
<td>9.64 (range: 3-14)</td>
<td>10.67 (range: 5-19)</td>
</tr>
<tr>
<td>Number of human-related images</td>
<td>40%</td>
<td>48%</td>
<td>84%</td>
</tr>
<tr>
<td>Coherence between collage and micro-narratives*</td>
<td>.84</td>
<td>.79</td>
<td>.84</td>
</tr>
<tr>
<td>Self-positioning**</td>
<td>.67</td>
<td>.64</td>
<td>.50</td>
</tr>
<tr>
<td>Missing image identification (completed Step 3)</td>
<td>14</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Juxtaposition (completed Step 4)</td>
<td>16</td>
<td>14</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: * Coherence: Approaching 1.00 indicates greater interconnectedness between collage images and micro-narratives
** Self-positioning: Approaching 1.00 indicates close to the centre of the collage, approaching 0 indicates positioning the self on the periphery.

Comparing the protocols across the three settings, it appeared that most children could follow the five sequential steps and complete each step without problem. The instructions were posed in the child’s native or preferred language and enabled the children to reflect upon their own memories, recollect significant and relevant stories, and choose the strategy for telling their stories.

Collage-making (CLET Step 1). The first step in the CLET involved making a collage using 10-12 images cut from magazines. The fieldworkers provided magazines with which the children would likely be familiar and that contained cultural cues reminiscent of their everyday lives. The magazines were social products or artefacts and could provide the children with the freedom to select images that represented their perceptions of family life, and to narrate their own non-verbal stories using cultural relevant cues instead of predetermined categories. The children selected images from the magazines to tell a (non-verbal) story about the family choosing both human-related and object-related images. The collages were generally constructed in a free-flowing fashion and were interpreted as broadly representing how the child remembered events related to the topic (i.e., the family). Figure 1 shows a selection of collages from each of the three settings. On average the children selected 10.94 images for the collage making with a range from 3 to 19. Except for Gaborone children, the children in other settings selected more object-related than human-related images. Selection of human-related images for the collage was considered as being congruent with the topic (i.e., family life), and a higher percentage of human-like images seen as reflective of the collage making stimulating memories about the topic (see Table 1). Cartoon characters were interpreted as human-related images as the children selected these images to represent family members and family events.
**Storytelling** (CLET Step 2). The collage making stimulated the storytelling about the topic, and represented the children’s ability to integrate the meanings of the visual images associated to perceptions of each family member. We analysed coherence between collage making and storytelling showing an interconnectedness between the collage images and the micro-narratives and stimulating a range of memories related to the topic (i.e., the family). In the Macao setting (84%), ZhuHai setting (79%) and Gaborone setting (84%) coherence emerged demonstrating the children’s ability to integrate symbolic meanings of the images with their thoughts and memories and recounting their stories about family life. They also managed to construct a coherent story line moving from one image to the next, reflecting some degree of cognitive organisation. The images on the collages, whether small or large, reflected a full range of memories relevant to the topic under investigation, and the children created non-verbal narratives telling vivid stories about their family life.

Micro-narratives emerged as the child was telling a story about the images on the collage. A female child from Macao, Hou (aged 11 years) narrated the following story for a ball pasted on her collage:

*I like playing volleyball and I am the volleyball team member of my school. My family are very supportive to me for playing volleyball as long as it does not affect my study. In the beginning they asked me to try first, but then I found that it is very interesting. Also because my school’s coach is a famous member in Macao’s volleyball team.*

Zhuhai children selected larger images, mostly from children’s magazines and cartoons, and pasted images in close proximity and somewhat overlapping. Human-like images were specifically selected to represent their parents, whom the children reported (in their micro-narratives) spent a great deal of time interacting with their single child. Elma, a 10-year old girl in Zhuhai, related the following story about her father when pointing to a bear-like image on the collage:

*He’ll [father/bear] come and help me to get up when I [little bird] fall or get hurt. He treats me well. Once I told him I hurt my leg when he picked me up after a dancing class. He took a medicine box from the car and put some medicine on my leg. Then we went back home together.*

The Gaborone children selected more human-like images to tell their non-verbal family stories. Gaborone is the capital city of Botswana and the participants in this setting mostly came from wealthy families although the country has one of the most skewed income distributions in the world \[32\]. In this setting, the fieldworker reported a limited variety of locally relevant magazines, which influenced the selection of images for collage making.

Only life magazines with images of celebrities and fashion could be provided to the child participants, and as in the sample collages from this setting (see Figure 1), some children pasted mostly faces that were cut on the edges and somewhat decontextualized. Nonetheless, the children constructed their collages creating non-verbal narratives expressing a range of memories about the topic. Their micro-narratives in the Gaborone setting also showed coherence across the non-verbal narratives and verbal narratives, and most of the stories directly related to the family or family members.

Kok (female, aged 11, intact family) said: *This is my mom, my dad, and me … this is a happy moment, when my mom, my dad and I visited another country … OK, that time we were travelling a lot like, sleeping over at my relatives and we had lots of fun.*

Roy (male, aged 11, parents divorced) said: *Image 2* It is a man … the man is angry … it reminds me when my dad was angry. *Image 7* A man … it reminds me of when my dad was happy … because it reminds me of when my family was happy.

**Self-positioning** (CLET Step 3a) and missing image (CLET Step 3b). When asked to position themselves on the collage it reflected, to some extent, how the child perceived their relationship to the story (e.g., memories of events) and to the actors (e.g., family members) in the story (Figure 1, marked with an X on the collage). The higher percentage of self-positioning in the centre of the collage (Macao: .67; ZhuHai: .60) rather than on the periphery (closer to 0) was interpreted as representing the self as the central character of their stories and perhaps having good memories and relationships in the context of the family. As the central character in their stories, the children in the Macao and ZhuHai settings, for the most part, told stories both non-verbally (the collage) and verbally (micro-narratives) about their family life filled with happy memories. In contrast, the Gaborone children positioned themselves either as central figure (3 children) or on the periphery as observer (3 children). Peripheral positioning of the children in all three settings was interpreted as an indication of troubled relationships and a wish to escape the present into a less troubling future. In this regard, the CLET alerted us to the need for further assessments and analysis, which could be done in a counselling setting and when planning an intervention. Further assessment was not done for this project because of the research context, but in some cases we alerted the arents that they should consider following up with social and/or mental health service providers.

Regarding the missing image (CLET Step 3b), some of the participating children seemed satisfied with their
first attempts at collage making to tell the non-verbal story. Only two of the six Gaborone children wanted to add an image, one related to the family and the other one an image reflecting a personal experience (e.g., swimming pool). In the Macao setting, four children (22%) and in the ZhuHai setting six children (43%) were satisfied with the collage not wanting to add any further images. The other children in these two settings did identify an image they wanted to add referring to object-related images that were seemingly important to the child (e.g., toy car, baby image, nature/animals, big house) or images of the family more generally (e.g., memory of a grandmother, big family photo). In the CLET, the missing image question encourages participants to reflect upon the silent voice in their stories and is aimed at eliciting rich narratives that could perhaps indicate an underlying problem or challenging relationship, and for which the SBFC practitioner might want to conduct further assessments.

Juxtapositioning (Step 4). In this project, most of the children in the Macao and ZhuHai settings could perform on the question regarding comparing similarities and differences. The Macao children discussed different characteristics of family members, happy or sad memories, and in one case issues related to unresolved grief. ZhuHai children could also comment on family-related dynamics such as harmonious family, studying hard to make the family proud, and the family not being the same as friends. Although a more challenging step in the CLET, juxtaposing similar and different images helped the children to reflect upon and narrate their emotions, their perceptions of the self in the family, and for the Chinese children their responsibilities towards family life more generally. Only one child in the Gaborone setting completed this step comparing facial expressions and emotional content of the images. The other Gaborone children did not want to comment for this step. Given that the children in the other two settings could complete this step without difficulty, we doubt that the low response rate was directly related to the child’s inabilities. Rather, we interpreted this as that the low response rate was directly related to the child’s inabilities. Rather, we interpreted this as that the child participants. Therefore, in this paper we do not discuss children’s actual perceptions of family life.

Closure and debriefing (Step 5). Overall, the children in all the settings found performance on the CLET a fun activity, allowing them to reflect upon their memories and thoughts and assisting the fieldworker build rapport and break down the barriers of the unfamiliar interview setting. In response to the final question posed by the fieldworker (i.e., “what did you feel like when making the collage and telling your stories?”), most children could respond with self-reflection and insight:

Andre (Macao male, aged 12): I picked the pictures without many thoughts at the beginning. But it turned out that I could talk many things about the pictures. It made me call back the things of my family; it made me remember the things that happened when I was small... because it made me think back to my past.

Jason (Macao male, aged 11): I found difficulties when choosing pictures but still I could find it slowly... I need to think for a while when telling the stories. [What do you feel now that we are almost done?] I think... pretty good. I could speak out something that I like and don’t like.

Henry (Macao male, aged 9): Um... a little bit bore... I want to finish it quickly... I can go to play. I like play computer. [Any problems during the interview?] Telling the story with the pictures... I don’t know how to say... don’t know what I am supposed to say.

Betty (ZhuHai female, aged 9): In a word... it is the happiest thing. I use these pictures to represent the care that my teachers and parents give me.

Riana (Gaborone female, aged 11): I’d like to say that I’m happy that you told me about this project... [and now?] I feel happy

Leo (Gaborone male, aged 12): It felt interesting and I was feeling happy [to make the collage]. I felt excited... it makes me feel excited about my family. [Now] I feel just fine.

5. Discussion

The main objective of this paper was to explore the utility of the CLET scaffolding or priming storytelling and creating space for children in middle childhood and in non-clinical settings to transform their remembering/knowing into telling. The topic for this particular study was the children’s perceptions of family. However, we did not analyse their views on the family per se but merely used this as a focus for conducting the CLET with the child participants. Therefore, in this paper we do not discuss children’s actual perceptions of family life. Rather, we focus on the usefulness of the CLET as a tool for stimulating narratives from children. The analysis of the collages and micro-narratives in the three settings—that is, in Macao and ZhuHai (China) and in Gaborone
(Botswana)—provided evidence that the five sequential steps of the CLET are useful to scaffold children’s autobiographical remembering. The different steps combined well to elicit rich and vivid memories, and to structure the micro-narratives that were focused and relevant. It was clear in all the settings that the CLET managed to engage the middle-childhood child in accessing their own unique memories and tell stories representative of the topic under investigation.

All the children in each of the three settings could construct non-verbal and verbal narratives that reflected an ability to cognitively organise and represent a range of memories about the topic. During the process of collage making, participants were fully in charge of their own work, which lessened the dependence on the fieldworker to ask questions and prompt the story telling. The collage making allowed the children sufficient freedom to develop their autonomy and help build a sense of competence while at the same time suggested a safe and reassuring environment for remembering and performing a full range of memories. Although some children found it difficult at first to select relevant pictures, they could eventually find images representing a range of significant memories pertaining people, object/artefacts, and life events. In some cases, the images were seemingly not relevant to the topic under investigation (e.g., objects, artefacts, nature, fashion). Nonetheless, these images were selected with the topic in mind and representing the child’s understanding of the topic. The symbolic meanings embedded in the images generally triggered memories of meaningful family events and object-related images represented family outings (travel, car), eating together (food), and artefacts that signified a family member or family life in general (e.g., jewellery, mobile phone, camera). Overall there was coherence between the collage and the micro-narratives, and we concluded that the collage making sufficiently stimulated or primed the recall of memories for children in middle childhood who were still somewhat constrained in verbal expression.

The size, cutting and pasting of images furthermore provided some insight into the fine motor skill development, the organisation of their memories, as well as the significance of the memories. Through pasting the images on the collage and their self-positioning the children revealed relationship patterns, distances or closeness to their significant others, and some emotional content that lurked below the level of awareness. The analysis further provided evidence that the memories elicited through collage making stimulated the children’s verbal expressions, and when the CLET is conducted as a face-to-face semi-structured interview following the five steps allowed for the elicitation of rich and vivid narratives from the participating children in middle childhood.

In this study, the researchers aimed to build a compelling case for the utility of the CLET. The aim was not to search for universal truths between the three settings or about the children’s perceptions of family life per se. Rather, the objective was to explore how well the steps of the CLET could converge to provide access to rich and realistic memories of children in middle childhood. By utilising the CLET, we argue that SBFC practitioners using this technique could gain insight into the concepts and behaviour within the setting, as well as the ways in which children made sense of their specific ways of being. The CLET is not a diagnostic tool but a screening tool for intake interviewing that could provide a source of hypotheses for further exploration either through additional (diagnostic) assessments or further clinical interviewing.

Performances on the CLET cannot and should not be interpreted as either true or false—there is no ultimate right or wrong way to tell their stories and there was no way to justify or validate whether the stories the children told were more correct in one setting than in another. Thus, the CLET and the stories elicited following the five steps are not truth-evaluable and thus not open to standardisation and norms required for specific diagnostic criteria. Instead, performances on the CLET are subjective and projective or representational meaning-making actions or part of the doing of a certain kind of co-action not normally forthcoming by just saying or describing something. When something is wrong with them then they are happy or unhappy, not right or wrong. The CLET is an expressive channel for conveying messages about the self and for modulating emotional impact on everyday functioning. It is also a process that is context-shaped and context renewing or transformative. Both fieldworker/researcher and client gain insights from collaborating in the sense-making process, which helps with developing a less problem-saturated life story and optimal functioning in different everyday life settings.

Thus, apart from its usefulness as a visual method for research with children, the CLET has implications when working with children in other contexts and when narrating a range of topics. When working with children in school-based or agency settings, the SBFC practitioner often has difficulty gaining access to stories of distress that lurk below the level of awareness. In this regard, the CLET has the potential to serve the clinician working with children to develop hypotheses or arguments for the nature of possible underlying problems in the various set-
tions. For example, a child expected to make a collage of family life and pasting decontextualized images of faces and unrelated objects in a random, disjointed and distant fashion could be telling a story of relationship distances, conflict and potential cut-off in family relations. If the micro-narratives contrastingly tell stories about family warmth and cohesiveness, the practitioner should be alerted to the child potentially hiding or being triangulated in these problematic parental relationships. Further exploration could then follow, and treatment planning appropriately designed to help the child (and family) develop along healthy lines.

Combining non-verbal and verbal narratives as in the CLET gives access to deeper meanings that might otherwise not be evident in children’s self-narratives. Chinese children in particular (e.g., Macao and Zhuhai settings) are often constrained by cultural prohibitions to self-disclose or tell stories that could affect the family’s face, and they tend to communicate only what they perceive the audience want to hear or what would reflect positively on the family. Here the CLET could make a contribution to intake interviewing with children in these contexts as it could elicit what lurked below the surface or was suppressed for fear of retribution. The CLET could access rich and vivid non-verbal and verbal representations, and could enable the researcher and clinician to develop hypotheses for further exploration.

6. Limitations

The project reported here did reveal some limitations of the CLET, particularly when conducted in the child’s non-native language. The language proficiency of children should be considered before implementing steps 2 to 5 of the CLET. Children with limited command of a language have greater difficulty to express their thoughts and feelings adequately. For example, Leo (Gaborone male, aged 12) narrating stories about decontextualized faces on his collage, said: “That’s my brother … I chose it because my brother likes being cool.” Leo’s micro-narratives mostly reflected limited expressions about a person in his family and he had difficulty reflecting on any further meanings. Using locally relevant magazines are intended to provide cues of culturally-relevant socialisation. Although this could be a limitation if sufficient and/or relevant magazines could not be found, there is the option of the SBFC practitioner compiling a resource base beforehand selecting a variety of images from relevant magazines and making these available to the children. The practitioner should make sure that this resource is culturally relevant to the child and contains a broad range of image categories for inclusion in the collage making. The child should also be able to cut the images to her or his liking before pasting them on the collage.

In this study, we had to rely on trained fieldworkers to conduct the CLET. It was unfortunate that some fieldworkers did not fully comprehend the importance of the five sequential steps and thus skipped a step when having difficulty to prompt the child in the face-to-face interview. Skipping any of the sequential steps could detract from the efficacy of the CLET as each step is purposefully designed to scaffold autobiographical remembering. Although the fieldworkers were carefully trained beforehand, their inexperience in the field in some cases jeopardized the completion of all the steps in succession. Nonetheless, for the analysis reported in this paper, we used only fully completed protocols where all five steps of the CLET were effectively and comprehensively followed.

7. Conclusion

Proposing an alternative mode of representation and narration (i.e., non-verbal telling), we concluded that the CLET allows for free expression of the child’s subjective and inter-subjective truths, even when the participant had difficulty recollecting their memories or the memories were about sad situations or events. The collage making and storytelling that constitute the central focus of the CLET allows the SBFC practitioner and researcher to elicit a full and realistic range of memories about the topic under investigation. Through the process of scaffolding autobiographical remembering, the CLET can provide a channel for dialogue about issues the child is not yet aware of and to elicit issues otherwise obscured from observation but where the counsellor or child therapist should direct the interventions. It can also prove useful to elicit areas of strength and weakness, coping styles and resources that the individual might still be unaware of at the point of research or intervention. The CLET is an innovative technique aimed to elicit vivid life storytelling by scaffolding or prompting narrative processes and providing a space for children to tell their stories.

References


[2] Han, J. J., Leichtman, M. D. and Wang, Q.. Autobiographical memory in Korean, Chinese, and Amer-
DOI: 10.1037/0012-1649.34.4.701  
DOI: 10.1037/a0012849  
DOI: 10.1075/ni.11.1.03min  
DOI: 10.1023/A:1011006402275  
DOI: 10.2304/ciec.2004.5.2.3  
DOI: 10.1080/00050060600976032  
DOI: 10.1037//0003-066X.56.10.803  
DOI: 10.1007/s10643-009-0324-1  
[22] Phelan, S. K. and Kinsella, E. A.. Picture this … safe-
ty, dignity, and voice—ethical research with children: Practical considerations for the reflexive researcher, Qualitative Inquiry, 2013, 19(2): 81-90.
DOI: 10.1177/1077800412462987
DOI:10.1191/1478088706qp062oa
DOI: 10.1177/1473325006070288
DOI: 10.1606/1044-3894.1783
**REVIEW**

**Behavioral Operations Management: A Review of the Field**

**Rosa Hendijani**

Faculty of Management, University of Tehran, Iran

---

**ARTICLE INFO**

**Article history**

Received: 8 April 2019
Accepted: 2 July 2019
Published Online: 30 October 2019

**Keywords:**
Behavioral operations management
Pure rationality
Bounded rationality
Biases
Heuristics

**ABSTRACT**

Behavioral operations management (BOM) is one of the new areas in operations management. In the past 12 years, the field has made huge progress and researchers have become interested in this new perspective to solving operational problems. BOM is now one of the major subfields of operations management. In this paper, we examine and categorize areas of BOM based on the mainstream literature. Key areas include behavioral issues in new product development and project management, quality management, production management, inventory management, service operations, and forecasting. Studies in each area are divided into three subcategories, including OM context, individual attributes, heuristics, and biases, and individual differences. In OM context category, feedback and reward, training, work monitoring, teamwork and group decision making, goal setting, task assignment, and flexibility are among the main topics. In individual attributes, heuristics, and biases category, sunk cost effect and escalation of commitment, endowment effect, overprecision bias, planning fallacy, pull-to-center effect, anchoring and insufficient adjustment, and misperceptions of feedback are mainly discussed. In individual differences, analytic thinking and system thinking are mainly studied. New areas for research are suggested in each related section and are summarized in future directions and conclusion sections. In contexts such as new product development, project management, and inventory management, a shift to finding solution to performance improvement is beneficial instead of focusing on heuristics and biases and considering them as a deficiency in human decision making. Regarding individual differences category, a shift toward attributes other than cognitive abilities, such as global processing, creative thinking, and design thinking are recommended.

---

**1. Introduction**

Humans play a significant role in the development and implementation of operational systems. Behavioral operations management (BOM) is a branch of operations management that focuses on the role of humans in operational settings. After 12 years of burgeoning research, BOM has now become one of the major subfields of operations management. It has become a multi-disciplinary area. Theories and research methods from other areas, including behavioral economics, organizational behavior, behavioral decision making, system dynamics, cognitive psychology, and social psychology have influenced the development of this subfield.

BOM started formally in 2006. In this year, Journal of Operations Management assigned a special issue to...
behavioral operations management \[4\]. This special issue coincided with the first behavioral operations conference in the US. Since that time, many journals in operations management have allocated one of their areas to behavioral operations management \[5,2,6\] and operations management conferences have assigned a track to behavioral operations. In addition, behavioral operations conference has been held internationally every year. This area has received an escalating attention from researchers in operations management and other related disciplines around the world.

In this paper, we review the literature on behavioral operations management in order to inform interested researchers of the key areas and the potential areas for future research. In the following sections, we will first provide a definition of behavioral operations management and clarify its boundaries. Then, we will discuss the areas and sub-areas within behavioral operations management \[3\]. We conclude our discussion by providing areas for future research.

2. Behavioral Operations Management Definition

As the field of BOM has expanded in recent years, it is important to provide a definition for it and determine what differentiates its research from other disciplines. Researchers in any field need to define the focus of their own research in order to create a common understanding among scholars in the discipline \[7,8\]. Several definitions have been provided for BOM in the literature \[9,5,3\]. Behavioral operations management is defined as a field of study that focuses on the behavior of individuals within operational contexts that deviate from rationality \[9\]. In other words, for a research to be considered in BOM area, it must have components of individual behavior within an operational context, the type of behavior that does not fall within the frameworks of hyper-rationality.

Based on this definition, BOM includes studies that address problems in operational contexts, deal with non-hyper rational actors, and their level of analysis is at the individual or group level. Operations management contexts have distinct challenges and complexities that distinguish them from general contexts addressed in other fields such as organizational behavior and social and cognitive psychology. The type of research in BOM is not based on the assumptions of hyper-rationality. They make the assumption that motivation and behavior are not shaped solely by self-interest and decision making is not always conscious and well-informed. In addition, the level of analysis is mainly individuals or groups of individuals who deal with operations management problems.

3. Areas of Research in Behavioral Operations

Behavioral operations management comprises many areas. Based on a categorization of BOM studies \[5\], the main subject areas include: supply chain management (27%), new product development and project management (17%), quality management (11%), production management (10%), inventory management (8%), service management (7%), conceptual studies (7%), forecasting (4%), and others (9%). In this paper, we focus on key areas in behavioral operations management, including, new product development and project management, quality management, production management, inventory management, service management, and forecasting. Studies in each of these areas are examined and discussed in the following sections. Behavioral topics in supply chain management have significantly grown in the past few years and have created a separate area called behavioral supply chain management \[10,11\]. Due to the length limitations, we do not discuss these topics in this paper.

The categorization and literature related to each area are determined based on the review papers in BOM literature. These review papers used in this study and their discussed areas are listed in the table 1. Following previous reviews, only empirical studies were included \[12\]. The review papers have mentioned several subareas. However, in one recent study on clustering \[11\], the authors found two clusters around inventory management problems, including newsvendor and bullwhip and inventory optimization clusters. The rest of the areas had no clusters around them. Conceptual and analytical studies were excluded since BOM mainly attempts to use empirical research methods especially experimental research to differentiate it from the traditional research in the field of OM. One of the reviews focused on experimental studies only \[12\]. Another review of the literature showed that 94% of the studies in BOM used empirical research methods and 43% used experimental ones \[5\].

In addition to considering the studies mentioned in the review papers, we actively searched the literature to find BOM papers published in each of the subareas in top academic journals in management and psychology in recent years. We searched for the BOM papers in several search engines including Google Scholar, Web of Science, Psyclnfo, and Scopus using key words related to behavioral operations and the related subareas. We used a combination of search terms including behavioral/behavioural, new product development, project management, inventory
management, quality, production, newsvendor problem, service, queueing, waiting lines, forecasting, judgmental forecasting, and behavioral operations. The final list included 73 papers that had empirically tested behavioral issues in each of the main categories.

Based on the review of the literature, we categorized the subareas in each of the main areas into two subcategories of operations management context and individual characteristics. Individual characteristics were then divided into two categories of individual attributes, heuristics and biases and individual differences. The behavioral issues in OM arise from the interaction between operational contexts and individuals that work within these contexts. Therefore, studies in BOM literature have examined the problems either from the standpoint of the characteristics of the OM context or the individuals within the related context. Studies in the OM context category focus on the context settings such as design of operational settings, motivational mechanisms, performance feedback, goal setting, and other contextual factors that influence the behavior of individuals. Studies in the individual characteristics category can be divided into two subcategories. One subcategory focuses on human attributes, heuristics, and biases and the other focuses on individual differences and their effect on operations management decisions. The review studies have also mainly viewed the literature from either of these two standpoints. For example, in one study, researchers examined the individual heuristics and biases that influence decision making in the OM context [13]. Similarly, another review categorized behavioral issues in OM into four categories of cognitive psychology, social psychology, group dynamics, and system dynamics, putting the emphasis on individual and group characteristics and their effect on decision making in the OM context [14]. On the other hand, other literature reviews [12, 15] mainly focus on the effect of operational context and its settings on the performance of individuals and groups working within these contexts. Factors such as individual versus group decision making and goal setting, independent versus interdependent task assignment, motivational mechanisms, and feedback type are among the ones that are addressed in these studies.

### Table 1. Review and conceptual studies

<table>
<thead>
<tr>
<th>Reference No.</th>
<th>New product development and project management</th>
<th>Quality management</th>
<th>Production management</th>
<th>Inventory management</th>
<th>Service management</th>
<th>Forecasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[5]</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>[12]</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

In table 2, the references related to each of the subcategories are presented. Areas with no references are the ones that have received the little attention and therefore, have the potential for future research. In table 3, the topics in each subcategory are presented. The topics in normal font include the ones that have been addressed in the past literature thorough empirical studies. The italicized topics include studies that have not been addressed empirically but have the potential for future research.

### 3.1 New Product Development and Project Management

One of the behavioral areas in operations management is new product development. Since problems in new product development are generally of a project nature, the problems and challenges in this area are often considered in the same category as project management problems [3]. Due to the high speed and flexibility required in project management and new product development, attention to behavioral issues are of great importance.

### 3.2 Operations Management Context

A series of studies examined the effect of feedback on performance in new product development projects. In one study, researchers examined the effect of relative versus absolute performance evaluation [16]. In relative performance evaluation, the performance of managers was compared with that of a peer group. In contrast, in absolute performance evaluation, the performance was assessed individually based on pre-specified performance standards. According to this study, relative performance evaluation resulted in better decision making among managers in new product development projects. Relative performance appraisals could increase managers' inclination to choose riskier capital investment projects, especially for firms in high-risk technological/economic conditions. In another study, the effect of cognitive feedback, cognitive feed-forward, and outcome feedback on performance was examined in the context of a simulated project on software development [17]. Participants played the role of project managers and made a series of decisions related to staffing over the life of the project. Different types of feedback were given to participants. The results showed that participants who received cognitive feedback performed best, followed by those who received cognitive feed-forward.

[126] x x x
In contrast, those who received outcome feedback did not perform well compared to others [17]. Other studies examined the effect of training on attitude towards divergent thinking among manufacturing engineers in problems related to new product development [18]. Results of the study showed that training had a positive effect on attitude towards divergent thinking in problem solving in new product problems.

Other studies in this line examined the effect of individual versus group goal setting and decision making on performance. In one study, researchers examined the effect of group versus individual goals on performance in new product development projects. They found that when collaboration was required and the tasks were inter-dependent, group goals were more effective compared to individual goals and resulted in better performance outcomes [19]. Group decision making compared to individual decision making can improve the quality of decision making and performance in different stages of new product development and project management, including initial investment [20] and later stages of a project [21]. In addition, virtual teams performed better than face-to-face teams in product development projects [21].

Review of the literature on behavioral new product development shows that studies have been mainly conducted in 90s and early 20s. These results suggest that new studies on behavioral issues in new product development are required to shed light on different aspects of OM context and their interaction with human behavior in this context.

### Table 2. Studies included in the review

<table>
<thead>
<tr>
<th>Area</th>
<th>OM Context</th>
<th>Individual Attributes, Heuristics and Biases</th>
<th>Individual Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>New product development and project management</td>
<td>[16], [17], [18], [19], [20], [21]</td>
<td>[22], [23], [27], [29], [31], [32]</td>
<td>[33]</td>
</tr>
<tr>
<td>Quality management and control</td>
<td>[42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52]</td>
<td>[52]</td>
<td></td>
</tr>
<tr>
<td>Production management</td>
<td>[52], [58], [59], [60], [61], [62], [64], [65], [66], [67], [68], [69], [70]</td>
<td>[56], [57]</td>
<td></td>
</tr>
<tr>
<td>Inventory management</td>
<td>[71], [72], [73], [81]</td>
<td>[72], [73], [74], [76], [77], [79], [80], [81], [82], [86], [87], [88]</td>
<td>[34], [35], [36], [89]</td>
</tr>
<tr>
<td>Service management</td>
<td>[93], [94], [95], [96], [97], [98], [99], [103], [104]</td>
<td>[105]</td>
<td></td>
</tr>
<tr>
<td>Forecasting</td>
<td>[37], [79], [116], [117]</td>
<td>[37], [79]</td>
<td>[37]</td>
</tr>
</tbody>
</table>

### 3.3 Individual Attributes, Heuristics, and Biases

Sunk cost effect or escalation commitment is one of the biases that have been widely discussed in the new product development and project management literature [13, 14]. It has a significant impact on allocation of resources to new product development and other types of projects. This bias leads individuals to allocate additional resources to projects, depending on the amount of money that has already been invested in these projects [22]. Higher amounts of initial investment result in higher likelihood of future investments even in situations where the project is threatened to be terminated. However, the effect has proved to be mitigated when sunk cost and negative feedback simultaneously occurred [23]. It was found that as the negative feedback increased, the likelihood of continuing the project decreased.

Sunk cost effect is linked with other types of decision making biases, including endowment effect, change resistance, and status quo bias which are the result of an underlying behavior referred to as loss aversion in the decision making literature [24]. Endowment effect refers to individuals’ tendency to give higher values to things that belong to them and lower values to things that do not belong to them or require them to change their acts and behaviors. Change resistance and status quo bias are related to the individuals’ tendency to resist change. People generally avoid changes even the positive ones and prefer to stay in their current conditions [25, 26]. These biases are frequent in new product development and project management. In the context of project management, these biases lead people to generally give higher values to the projects to which they are committed and have already invested compared to other projects. In one study, managers who had started a project were less likely to accept its poor performance, were generally more committed to the project, and were more likely to continue investing when it was more reasonable to stop the project, compared to those who later assumed management of the project [27].

Overprecision bias is another bias that influences the estimation of project duration. Previous studies have shown that individuals generally indicate very tight time intervals when asked to estimate the length of a project. This bias is mainly due to the fact that individuals generally underestimate the variance inherent in different phenomena [28]. In one study, researchers asked participants to estimate the time required to complete a software engineering project. The results showed that the participants systematically predicted too tight estimates of the project time duration [29]. In fact, more than half of the actual outcomes fell in the 1% tail of the estimated distributions.
The study showed that overprecision bias was not reduced by task decomposition, changing the wording or order of questions, or estimation training. However, the study showed that inducing participants to provide extreme lower and upper plausible time limits, significantly decreased overprecision bias and resulted in more accurate time estimates.[29]. Overprecision bias has implications in other OM areas as well, such as inventory management and forecasting. These will be discussed in the related sections.

Another common bias is planning fallacy, which is the systematic tendency to underestimate the amount of time required to complete a project. This fallacy results in the underestimation of time and resources that are required to complete a project. It is related to hyperbolic discounting.[30]. Hyperbolic discounting reflects the tendency to mentally value present significantly higher than any time in the future. In other words, individuals have an inclination to give higher weights to what happens now compared to any time in the future. Immediate costs/rewards are much more salient in one's mind, resulting in decisions that provide high instant satisfaction and low long-term ones. Planning fallacy and hyperbolic discounting have implications on decision making in project management and new product development, due to the inter-temporal nature of decision making in these contexts. Decisions on project

Table 3. Areas of research

<table>
<thead>
<tr>
<th>Area</th>
<th>OM Context</th>
<th>Individual Attributes, Heuristics, and Biases</th>
<th>Individual Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>New product development and project manage-</td>
<td>Feedback, Performance evaluation, Training, Group vs. individual goal setting, Group vs. individual decision making</td>
<td>Sunk cost effect and escalation of commitment, Endowment effect, change resistance, and status quo bias, Overprecision bias, Planning fallacy and hyperbolic discounting, Misperceptions of feedback</td>
<td>System thinking, Cognitive ability and analytical thinking, Global information processing, Intuitive thinking, Design thinking</td>
</tr>
<tr>
<td>ment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality management and control</td>
<td>Feedback, Performance evaluation and control, Work monitoring, Forced standards, Work sharing, Training, Team work, cross training, and work flexibility</td>
<td>Attribution and blame error, Confirmation bias, Stress and fatigue, Law of small numbers, Illusion of control</td>
<td>Cognitive ability, Personality traits such as openness to experience and conscientiousness, Risk attitude, Ambiguity tolerance, Stock-flow understanding</td>
</tr>
<tr>
<td>Production management</td>
<td>Performance monitoring, Feedback, Work interruption, Reward and task interdependence, Goal setting, Work/task organization, Work pace, Inventory level</td>
<td>Law of small numbers, Confirmation bias, Sunk cost fallacy, Anchoring and insufficient adjustment</td>
<td>Cognitive ability and analytical thinking, Global information processing, Stock-flow understanding</td>
</tr>
<tr>
<td>Inventory management</td>
<td>Motivational mechanisms such as rewards, Feedback, Learning, Goals, Inventory separation</td>
<td>Demand-chasing heuristic, Anchoring and insufficient adjustment, Over-precision bias, Pull-to-center effect, Availability heuristic, Risk attitude, Procestation, Inconsistency bias</td>
<td>Cognitive ability and analytical thinking, Global information processing, Stock-flow understanding</td>
</tr>
<tr>
<td>Service management</td>
<td>Service and wait line design, Queue structure, server pooling, and cross training, Task interdependence, Feedback saliency, Payment schemes</td>
<td>Experiencing vs. remembering self, Emotion, Trust, Choice, Anchoring and insufficient adjustment</td>
<td>Cognitive ability and analytical thinking, Global information processing</td>
</tr>
<tr>
<td>Forecasting</td>
<td>Collaborative forecasting, Decision making speed</td>
<td>Over-reaction and under-reaction to error, Censorship bias</td>
<td>Cognitive ability and analytical thinking, Global information processing, System thinking, Stock-flow understanding</td>
</tr>
</tbody>
</table>

Note: Areas with italicized font have not been empirically tested in the literature.
scheduling and financing and decisions on continuing or terminating new product development projects are some examples. They result in delays in projects even in relatively stable conditions. Motivational mechanisms are suggested as a method to help project managers reduce these biases and improve their estimation accuracy [31].

In another study, researchers found that misperceptions of feedback in the form of inadequate consideration for important feedback, time delays, and system nonlinearities had a significant negative effect on performance in a new product development task [32]. The performance was poor even when participants repeated the game in several rounds.

### 3.4 Individual Differences

Individual differences have not been significantly studied in project management and new product development. One study examined the effect of system dynamic understanding on project management [33]. System dynamic understanding is one aspect of system thinking which focuses on the ability to understand the dynamics of systems and their related features such as feedback and delays. The results showed that system dynamic understanding and the similarity between individuals' understanding and that of their team members had a significant positive effect on psychological safety and quality of information sharing in project teams which in turn influenced project performance.

Individual differences in analytical thinking and global information processing are some potential areas for future research. Previous studies have examined the effect of these two individual differences on performance in OM contexts, such as stock-flow problems [34, 35], inventory management [36], and forecasting [37]. These individual differences might have the potential to reduce decision making biases such as overprecision bias, planning fallacy, and hyperbolic discounting. Analytical thinking style can help people analyze a problem from a more rational standpoint and better estimate the required times for different stages of a project. Global information processing compared to local processing allows individuals to look at the big picture of the project and consider all the factors that might influence the completion time of the project. Thus, these two factors might help in decreasing cognitive biases in decision making and result in a more accurate estimation of the length of a project. Other individual differences such as intuitive thinking [38] and design thinking [39, 40] can also be considered as individual differences that can help in the design and development of new products. These characteristics have the potential to help in finding simple, familiar and intuitive solutions to problems in the area of new product design and development.

### 4. Quality Management and Control

Behavioral studies in quality management and control have long been conducted in operations management. Influencing the behavior of individuals including organizational members and customers has a pivotal role in implementing quality programs such as Six Sigma and Total Quality Management [9]. Thus, behavioral issues are highly relevant to the design and implementation of quality management programs in organizations.

#### 4.1 Operations Management Context

Feedback can have a significant effect on quality control. It can improve quality by increasing the level of self-inspection [41] and mistake proofing [42]. One study examined the effect of different types of feedback (2 types: immediate versus delayed x 2 types: self-paced versus machine-paced) on performance in a quality control task. Error detection accuracy in quality control was higher in self-paced compared to machine-paced and in immediate compared to delayed type of feedback [43].

Work monitoring have also been examined in some studies. On study examined the effect of management monitoring and control on performance in a work setting in which individuals are free to manage multiple tasks [44]. While work monitoring had positive effects on the quality of monitored tasks, it had negative effects on the quality of non-monitored tasks. Another study showed that delaying monitoring events in error identification tasks resulted in better performance [45]. This was regardless of the type of information and guidance that could be provided by the monitoring system.

The effect of process control on perception of quality was tested in another study. The results showed that process control can have a positive effect on individual's perception of process quality [46]. Experiments done by researchers in this study indicate that individuals prefer processes with higher levels of control to the ones with lower levels of control. The role of training and decision support systems on assessment of quality control have also been studied. The results showed that when the type of training was matched with individual's prior knowledge and mental model, it was effective and resulted in better learning and more accurate assessments among individuals [47]. Teamwork, cross training and flexible work are also mentioned in the literature as methods to decrease error and improve the quality of operational processes [48, 49, 50, 51].

In another study, researchers conducted a series of experimental studies to examine the effect of different con-
textual and behavioral factors on quality [52]. The results supported the negative effect of forced standards and individuals' stress and fatigue on process quality. In addition, the study highlighted the positive effect of work sharing on process quality. This study also focuses on resistance to change and its sources in process improvement programs.

4.2 Individual Attributes, Heuristics, and Biases

One of the main decision making biases in the quality management context is related to attribution and blame error. Process quality is often assessed with the level of statistical control. All processes have variation and a large percentage of the variation is random [53]. Managers, however, often have the implicit assumption that the process outcomes are deterministic or have an insignificant level of variation. Such mental assumptions lead them to look for causes in the form of finding someone to blame when processes produce defective outcomes. Blame attribution mostly occurs without considering the possibility that the defects may be the result of the random variation inherent in the process. In psychology, this error is called fundamental attribution error [54]. It leads individuals to look for someone to blame without considering the random nature of the processes. The mistaken assumption that every variation has an assignable cause leads to process tampering. That is, process operators and managers intervene with the processes and modify them when they should do nothing [53, 55].

Studies have shown that statistical process control techniques can help in identifying and separating common cause variation from special cause variation and avoid their related problems [55]. Distinguishing these two types of variation can decrease the level of process tampering and help in correctly identifying special cause variation which need immediate care and attention in order to avoid its occurrence in the future.

Other types of decision making biases can also influence quality management. Confirmation bias can influence the acquisition of information related to quality management and control. It refers to the individuals' tendency to search for information that satisfies their perspective or hypothesis. In quality management, this bias can result in judging the quality of products and services based on the positive reviews from satisfied customers and disregard the reviews from dissatisfied customers [113]. Law of small numbers is another heuristic that can influence decision making in quality management. This heuristic refers to the individuals’ tendency to consider small samples as representative of the larger population from which they are obtained. It will lead in mistaken interpretation of data collected from customers in market research or in system tests in statistical quality control. Illusion of control is another bias that leads people to believe that they have control over or can impact the systems or their outcomes [13]. In quality management, illusion of control may force individuals to believe they can influence the variation in processes and therefore, give rise to acts of tampering. As mentioned above, in the case of common cause or intrinsic variation, this behavior can result in interference with the system when the system is in fact normally functioning.

4.3 Individual Differences

Individual differences have an effect on quality control training programs. In one experimental study, researchers found that individual characteristics including cognitive ability, openness to experience, and conscientiousness influenced the effectiveness of error training programs. Participants were randomly assigned to three conditions of control, error encouragement, and error avoidance. The results showed that cognitive abilities and personality traits influenced the effectiveness of training program. Participants who were high on cognitive ability or openness to experience benefited more from error encouragement training programs [56]. In another study, researchers examined the effect of attitude towards risk and tolerance of ambiguity on sample size decision in quality control check [57]. The effect of these attitudes was tested under different levels of risk and ambiguity. The results showed that individuals' attitude towards risk and ambiguity influenced sample size selection. In addition, participants with higher levels of risk and ambiguity tolerance preferred smaller sample sizes and had higher confidence in their decisions even under high risk and ambiguity conditions.

5. Production Management

Production management is one of the main areas in operations management. Behavioral issues play an important role in production management.

5.1 Operations Management Context

Context characteristics such as feedback [58, 59, 60], work interruption [60], goals [61, 62], task interdependence [62, 63, 64, 65], work/task organization [52, 66], work pace [60], inventory level [67], and performance monitoring [68] have been the focus of behavioral studies in production management systems. These studies show that task performance in production systems is dependent on the OM context and these factors can influence performance of individuals and groups in different ways. In one study, performance monitoring proved to have a positive effect on performance among highly skilled workers [68]. Another study
on feedback showed that team feedback influenced the level of reported collaboration and civic virtues among team members. Groups that received positive feedback reported significantly higher levels of team collaboration and civic virtues compared to groups that received negative feedback [58]. In production lines, performance feedback decreased average processing time in total and among fast workers, indicating improvement in performance of operational systems [60]. Similarly, in another study, workers increased their speed when they felt they were the cause of delay in the production line [69]. The speed of coworkers acted as a feedback which influenced individual's performance. In addition, reward interdependence resulted in the formation of productivity norms among coworkers [69]. Work interruptions, on the other hand, increased processing time, indicating that work interruptions can result in significant productivity loss among workers [60]. In another study, researchers examined the effect of different types of feedback on productivity and performance of workers in an IT-based system for credit card applications [70]. The results show that direct negative feedback results in performance improvement, while direct positive feedback does not significantly improve performance. In addition, indirect negative feedback decreases productivity. But, indirect positive feedback does not influence it.

Different aspects of goal setting also influenced performance as examined in several studies. One study found that goal content (quantity vs. quality) influenced work processes while goal form (gradually difficult vs. fixed and difficult) did not influence processes or performance outcomes [61]. Process-related goals resulted in more process changes but resulted in lower quality performance compared to outcome goals. In addition, outcome goals had a delayed effect on performance. Another study found that goal type (no specified goals, individual goals, and group goals) interacted with monetary incentives and type of production system (push versus pull) [62]. Group goals used in a pull production system increased productivity compared to a push system with no specified goals. Task interdependence and goal setting had an interaction effect on motivation towards the task [64]. Work organization can also influence performance. One study examined the effect of work organization in the form of the work flow policy used in production lines [66]. The results of this study showed that different work flow policies influenced both between-worker variability (i.e., heterogeneity) and within-worker variability which in turn, influenced performance. In particular, work-sharing policy increased heterogeneity and worker variability. While, fixed assignment policy decreased them.

Inventory buffer level also influences the performance of workers in production systems. It has been used in production lines to avoid variation in production speed in different work stations and decrease the issue of blocking and starving in production systems [13]. However, behavioral studies show that when the inventory buffer is low or is completely eliminated, workers change their speed in a way that the congestion and long lines of work-in-process items is prevented. In other words, the elimination or reduction of buffer results in higher coordination among workers and increase in the pace of low-speed workstations. This will automatically prevent the occurrence of congestion or idle time in production systems. In two studies, researchers found that the speed of work in low-inventory production lines was higher than that of high-speed production lines. The increase in speed was to the level that it covered the cost of blocking and starving in such lines [62, 69].

Behavioral studies in production systems as explained above indicates the existence of a wide variety of studies on the effect of different context characteristics on performance of individuals. However, the number of studies in this line have declined in recent years. It would be worthwhile to conduct more recent studies to extend this line of research in behavioral operations.

5.2 Individual Attributes, Heuristics, and Biases

Regarding individual attributes, heuristics and biases, empirical studies were not found in the literature. However, several heuristics and biases, such as the law of small numbers, confirmation bias, sunk cost fallacy, and anchoring and insufficient adjustment could potentially influence performance in production management systems [13]. The law of small numbers can lead decision makers to make erroneous decisions regarding the production of different products based on a small sample of sales data or customer feedback. Similarly, confirmation bias can lead decision makers to consider and interpret the trends in production of different types of products based on their own prior beliefs. The sunk cost fallacy may force individuals to continue in-house production or outsourcing some activities even when the current situation does not seem beneficial [13]. Anchoring and insufficient adjustment can force decision makers to anchor their production level to the average demand in previous periods disregarding the level of standard deviation of the demand distribution. Since heuristics and biases can significantly influence decision making in different OM context, it is suggested that more studies focus on heuristics and biases in production management systems.
5.3 Individual Differences

Similar to heuristics and biases, individual differences have not been specifically studied in the production management context. As mentioned before, individual differences such as analytical thinking style and global information processing have been proved to influence performance in other OM areas such as stock-flow problems, inventory management and forecasting. It is worthwhile to examine the effect of these individual differences on performance in production management context as well. There is a possibility that these individual differences influence performance in this context as well.

6. Inventory Management

Inventory management is one of the areas that has been studied widely from a behavioral perspective. In this section, we will review and discuss three common areas in behavioral inventory management.

6.1 Operations Management Context

In one experimental study, researchers examined the effect of different motivational mechanisms on performance in inventory audits. They examined the effect of rewards that were based on single or multiple goals on performance in inventory management decisions. The authors also examined the effect of learning, feedback, and goal adjustment on performance of individuals in a repeated inventory management system. The effect of feedback and learning on performance was also studied in other inventory management experiments. In one study, incorporation of experience and feedback had a significant positive effect on optimal ordering in inventory management. In another study, however, feedback and learning did not improve performance.

In a conceptual study, researchers suggested that separating different types of inventory such as cycle inventory and safety stock can result in better management of each of these inventories. This method can be beneficial because each inventory has its own purposes and sources of variability. Assigning separate inventory managers to each of them can help in better examination of how these sources of variability have been addressed by their managers. This idea is interesting to be tested empirically in future studies.

6.2 Individual Attributes, Heuristics, and Biases

Heuristics and biases have been studied in both single-echelon and multi-echelon inventory management. Single-echelon inventory management system mainly focuses on the newsvendor problem. Newsvendor problem defines the problem of a person who should sell his/her products within a certain time period, facing demand uncertainty. The seller should decide how much to order based on his/her prediction of demand. Ordering decision should be made prior to the beginning of the period and cannot be changed once the demand occurs. The challenge in the newsvendor problem is to find the optimal ordering point where the total cost of under-ordering and over-ordering is minimized.

Even though there is an optimal ordering solution in the newsvendor problem, decision makers systematically deviate from it. As one study shows, individuals tend to order above the optimal solution for low-margin products and below it for the high-margin ones. Experimental studies highlight several behavioral factors, including the tendency to reduce ex-post inventory error (i.e., demand-chasing heuristic) and anchoring and insufficient adjustment. Demand chasing heuristic causes one to use the demand at the previous period as the measure for the next period instead of looking at the general pattern of the demand distribution. Anchoring and insufficient adjustment causes one to anchor his/her order to a predetermined value (usually the mean demand) and insufficiently adjust it based on the variance to reach the optimal level.

Other biases related to the newsvendor problem include: over-precision bias and pull-to-center effect. Overprecision bias causes one to underestimate the variance in the demand distribution and therefore, make errors in their ordering due to lack of attention to the inherent variance in the demand distribution. Pull-to-center effect leads the individual to anchor his/her ordering level for a period close to the mean and insufficiently adjust it based on the variance in demand distribution to reach the optimal ordering level. Pull-to-center effect results in ordering levels that are close to the mean and neglect or underestimate the variance of the demand distribution. In one study, researchers found that overprecision bias had a significant effect on performance in the newsvendor problem. The bias had a high correlation with order bias and predicted one third of the ordering mistakes. Learning and other inventory dynamics did not decrease overprecision bias. However, the authors used an intervention in their second experiment, that significantly reduced this bias. Apart from different types of biases, one study examines the role of bounded rationality on decision making error in the newsvendor problem.

Behavioral studies on multi-echelon inventory management systems have mainly focused on the reasons behind variation in supply chain and the occurrence of the bullwhip effect phenomenon. Bullwhip effect refers...
to the increase in the variation of orders as one moves up the supply chain [31]. This effect leads to forecasting errors, product shortage, price fluctuation, high inventory levels, low capacity utilization, and finally low quality [64]. Some of the operational reasons of bullwhip effect are order synchronization, batching, information uncertainty, delays, price discounts and promotions, and shortage gaming [65]. However, behavioral studies show that even after the operational causes of the bullwhip effect are removed, it still remains due to behavioral reasons. One study found that underweighting the supply line of unfulfilled orders was a systematic bias that contributed to bullwhip effect [86]. Another study replicated these results and extended them to stationary demand distribution and conditions where operational causes were removed [87]. Bullwhip effect remained even when operational causes and demand uncertainty were eliminated [88]. Another experimental study found that bounded rationality in the form of incomplete knowledge can result in bullwhip effect even when no biases are present [82].

Other heuristics and biases can also influence decision making in inventory management systems that have not been previously studied in the context of inventory management. Availability heuristic refers to one's tendency to judge the likelihood or frequency of an event based on the ease with which the event can be remembered. In inventory management, this heuristic can influence risk perceptions when making ordering decisions [13]. An individual might overestimate the risk of inventory overstock or understock for a particular product based on the availability of a similar event in his/her mind. This can in turn result in errors in inventory management decisions. Procrastination is another individual characteristic that can influence inventory management. Procrastination can lead inventory managers not to update the inventory management policy which results in many overstock or understock conditions [13]. Inconsistency bias refers to one's inability to judge consistently in repetitive cases or events. In inventory management, this bias leads inventory managers to change their inventory policies/rules when making identical ordering decisions in different time periods [13].

6.3 Individual Differences

One empirical study examined the effect of thinking style (rational versus intuitive) and information processing style (global versus local) on stock-flow understanding [15]. Inventories are one example of stock-flow systems. Raw materials, work-in-process, and finished goods come into the inventory (i.e., inflow) from one side and items picked up from inventory go out of it (i.e., outflow) from the other side. The results of this study showed that rational thinking style had a significant positive effect on performance in stock-flow problems. In another study, researchers found that global compared to local information processing had a significant positive effect on stock-flow understanding [34].

Other studies examined the effect of rational/intuitive thinking style on ordering error in single-echelon [36] and multi-echelon [89] inventory systems. These studies showed that rational compared to intuitive thinking style resulted in better ordering decisions and lower levels of error.

7. Service Operations

Service management is another area in operations management. Due to the increasing percentage of service companies, service management has become one of the challenging areas in operations management. Several characteristics of services, including high rate of human capital, presence and role of customers in the service creation, the simultaneity of service creation and consumption, and customers' low tolerance for waiting have made behavioral issues an important aspect of managing service companies [90]. In this section, we discuss behavioral issues in service design and waiting line management.

7.1 Operations Management Context

Managing waiting lines is one key area in service management. It has a significant impact on customer satisfaction. Several studies have focused on the behavioral factors that can influence waiting time perception. Perceived waiting time has a significant effect on customer satisfaction [91, 92]. Methods have been suggested to influence perceived waiting time, including the use of entertaining activities, peripheral services, music [93, 94, 96], television programs [97], good smells [98], and journals, menus, and brochures [99]. Different types of visual and auditory distractors can help fill individuals' time and decrease their perception of waiting time [100].

In addition to the studies that have focused on distractors and their effect on perceived waiting time, several studies have focused on the behavioral effects of different queueing systems both on the customers and the servers. Some studies have examined the effects of single-queue compared to multiple-queue systems. In recent years, many companies have changed their queueing system from multiple-queue to single-queue systems, also known as server pooling [101]. Based on queueing theory, server pooling can increase worker productivity, decrease idle time and therefore, reduce customer waiting time [102]. Behavioral studies, however, have shed light on the impacts of this change on the behavior of servers. In one study,
researchers examined the effects of queue structure (single vs. multiple queue systems) and queue-length visibility (full vs. blocked visibility) on worker productivity. Single queue system and blocked visibility resulted in server slow-down. Task interdependence and feedback saliency were mentioned as the behavioral drivers of these effects. These negative effects can mitigate or eliminate the positive effects of single-queue systems on server productivity and customer waiting time. The design of payment schemes that provide reward for fast performance and are based on the number of customers served by each worker can help mitigate these negative effects [103]. In another study, researchers examined the effect of a shift from a traditional referral system (i.e., multiple queue structure) to a centralized referral system (i.e., single queue structure) in healthcare. The results showed that centralized referral system can result in higher referral rates to specialists among high-confidence general practitioners [104]. This result implies that increase in the referral rate might mitigate or neutralize the positive effect of central queue referral system on patient waiting time.

7.2 Individual Attributes, Heuristics, and Biases

One of the biases that influences behavior in service management is related to the individuals' differential view to the experiencing self and remembering self. Individuals' perception of an event while experiencing it differs from their perception after the event. In one study on patients undergoing colonoscopy, researchers asked patients to report their level of pain on a 1-10 scale every 60 seconds during the process. The level of pain was asked one more time after the process ended. The results of this study showed that the best predictor of perceived pain after the process was the average of the maximum level of pain during the process and the level of pain at the end of the process. In addition, the process duration did not have any effect on the perceived pain even though the process duration changed between 4 and 69 minutes. The results of this study and other related ones [105, 106] highlight the role of three factors on how an experience is remembered: 1) the pattern or sequence of good and bad events, 2) the high and low points, and 3) the ending point of the experience. People pay attention to the trend of events and prefer experiences that have an improving trend. In service, this means that people prefer services that have a trend of improvement and progress. In addition, service ending is important since people remember the ending points more than other parts of the service after the experience is over [9]. In another study, researchers found that the individual's perception of progress towards their goal during the service process positively influences their choice of service [46].

Other behavioral issues can also influence customer's perception and satisfaction with the service process. Three behavioral elements of emotion, trust, and control are among the most important ones [107]. Regarding emotions, understanding the type of customer emotions and responding to it accordingly can help influence customer feelings in a positive way. Providing consistent services and giving motivated response to errors in the service process can help build trust and loyalty among customers. The feeling of choice and control over the service process is another important factor that can contribute to service satisfaction. People feel more comfortable and happier when they feel some control over the service process. In many cases, the choice can only be a symbolic one, but it can significantly increase customer satisfaction [107, 108]. As one experimental study indicates, blood donors who were allowed to choose the arm for blood drawing felt significantly more comfort compared to those who were not given the choice [109].

7.3 Individual Differences

Individual differences have not been mainly studied in service management. Similar to other areas differences in thinking style can influence people's perception of the service process. Individuals who have an analytical thinking style might have a more accurate estimation of their waiting and service time compared to those who are less analytical. In addition, processing style can influence people's perception of service quality. Individuals who have a global processing might have a more accurate evaluation of the service quality because they consider all aspects of the service process in their evaluation. On the other hand, individuals who have a local information processing might consider more salient aspects of the service in their evaluation of the service.

8. Demand Forecasting

Forecasting is one of the main inputs in decision making in operations and supply chain management. Improvement in forecasting can have a significant effect on increasing decision making quality and decreasing operations management costs [110]. Although many quantitative methods have been developed to improve the quality of forecasting, the decisions are still made based on judgment [111]. Even in cases where quantitative methods are used, individuals' judgment influences the forecasting process and the final decisions [37]. Studies in a large international pharmaceutical firm show that only 50% of the experts used quantitative methods for forecasting [112]. Another study shows that managers intervened and changed the results of quantitative methods in 78% of the companies that actively used
such methods [113].

### 8.1 Operations Management Context

Team-based and collaborative forecasting can help mitigate decision making biases and improve the quality of forecasting decisions [114]. In this way, Collaborative Planning Forecasting and Replenishment (CPFR) is one method for increasing the accuracy of forecasting decisions that creates a collaborative decision making platform for suppliers and customers to collaborate on making forecasting decisions on the internet [115]. Studies have also shown that individuals make more accurate forecasting decisions when the forecasted phenomenon had small nonlinearities and the forecasting horizon was short. On the other hand, in cases where the phenomenon had an exponential distribution with large growth rates and forecasting horizons, the level of forecasting error was large [116, 117]. In one study, researchers examined the effect of decision making speed on performance in time series forecasting. The results showed that forecasting error increased when decision speed was either very slow or very fast [77].

### 8.2 Individual Attributes, Heuristics, and Biases

In behavioral operations, a few studies have focused on individual attributes, heuristics, and biases that influence decision making in forecasting. In one study, researchers examined performance in time series forecasting. The results showed that individuals tend to over-react to forecasting errors in stable conditions and under-react to errors in unstable conditions [79]. In another study, researchers examined forecasting in censored environments, where the existence of a censorship point results in significant misrepresentation of the observed sample. The results show that individuals show what is referred to as censorship bias. They tend to rely on the censored sample and extend its behavior to the underlying population, disregarding the incomplete nature of this population [118]. In addition, since ordering in the newsvendor problem is partly a demand forecasting task, behavioral studies in the newsvendor problem can also be listed in this group.

In psychology and economics, several studies have been conducted on judgmental forecasting and its associated behavioral errors. A series of studies focus on mental heuristics and biases that influence judgmental forecasting [119]. Three mental heuristics, including representativeness bias, availability bias, and anchoring and insufficient adjustment can negatively influence judgmental forecasting [119, 120]. Representativeness bias refers to the prediction of a phenomenon based on its degree of similarity with the parent population and its salient characteristics, instead of using rigorous statistical analysis. This bias causes the decision maker to ignore the effect of prior probabilities, sample size, and regression to the mean when forecasting a phenomenon. Availability heuristic in forecasting results in basing the forecast related to a phenomenon on the ease of retrieving related information from memory. This is influenced by several factors, including familiarity [121], imaginability [121], and vividness [122]. Anchoring and insufficient adjustment heuristic happens when there is a reference point in the form of an initial estimate or a priori forecast. This reference point acts as a mental anchor that individuals start at and then, adjust it upward or downward based on their information and judgement to reach their final estimate. For example, in forecasting demand for the next period (e.g., next week or next month), usually the average demand acts as the mental anchor; demand for future periods is often predicted to be close to the mean and is insufficiently adjusted for the variance in demand. This pattern in forecasting is referred to as the pull-to-center effect which was discussed in the inventory management section [72, 73].

### 8.3 Individual differences

In one study, researchers examined the role of decision making style on performance in judgmental time-series forecasting [37]. The results indicated that decision makers who were high on rationality as measured by their cognitive reflection score made better forecasting decisions. This effect remained after controlling for their intelligence.

Other potential areas for future research on individual differences in forecasting include information processing and system thinking. Since forecasting decisions require one to look at the phenomenon in the long run, global perspective can help in making more accurate decisions and considering the patterns of changes over the long run. System thinking can also help with considering the dynamics of the events and the environment and incorporating system characteristics in forecasting decisions. This can result in more accurate forecasting decisions.

### 9. Future Directions

The review of the literature shows that there are gaps in the literature in each of the operations management areas. These gaps provide opportunities for researchers to conduct in-depth empirical studies in each of these areas to increase and expand knowledge in each of them. Each of these areas and their suggestions for future research were discussed in the related section.
In new product development and project management, a review of the literature shows that most studies in this category have been conducted a long time ago. In fact, most of the behavioral studies categorized in this line are mostly conducted before the emergence of behavioral operations as a separate field in operations management. From the perspective of operations management context, new studies on feedback, goal setting, and decision making are needed to enrich the literature. In the individual characteristics line, new studies are required to examine the effect of different heuristics and biases and to provide ways to mitigate them in this context. Regarding individual differences, analytical thinking and global processing can be studied as the individual differences that can help mitigate the deviations from rationality. Therefore, these individual characteristics can help mitigate heuristics and biases such as sunk cost effect, endowment effect, over-precision bias, and planning fallacy and hyperbolic discounting. As previous studies in this line suggest, system thinking can have a positive effect on project performance through its effect on psychological safety and information sharing among project team members [33].

In quality management and control, there are many potential areas for future research specially in individual characteristics subcategories. Regarding heuristics and biases, previous studies have suggested several biases such as attribution and blame error [9], confirmation bias, law of small numbers, and illusion of control [13]. Future studies are required to empirically test these biases and ways to mitigate them in the quality management context. Regarding individual differences, stock-flow understanding is an individual characteristic that can be beneficial. Quality management and control systems are stock-flow systems in nature. Improvement activities can help increase the stock of capabilities. On the other hand, allocating resources to everyday work will leave no time and resources to increase the stock of quality processes. This will lead to a spiral of declining capabilities, referred to as capability trap in the literature [123, 124]. Stock-flow understanding will safeguard against capability trap by giving the ability to understanding the dynamics of quality management and improvement in the operations management processes [35]. Stock-flow understanding can have a significant effect on performance in other OM areas including production management, inventory management, and forecasting due to their stock-flow nature.

In production management, individual characteristics are mainly understudied and have potential for future research. In inventory management, most of the studies focus on the individual characteristics with few studies on OM context. Thus, characteristics of OM context need further attention in inventory management area. In service management, there is a large body of research on the OM context, including service design, waiting lines and queueing systems. In individual characteristics subcategory, many conceptual studies that highlight the importance of individual factors such as the difference between experiencing self and remembering self and factors such as emotion, trust, and choice. However, empirical studies specially in the form of experimental studies in operations management context are missing to provide support for these propositions. In forecasting, studies need to be conducted in all different subareas to give a better understanding of the nature of behavioral issues in forecasting. While studies in the newsvendor problem partly overlap with forecasting problems, more studies are required to examine and highlight the unique nature of forecasting problems in OM context.

10. Conclusion

Behavioral operations management has become one of the main areas in operations management. What distinguishes this area as a new branch in OM is the emergence of new areas and research methods that allow researchers to examine the role of humans in decision making and performance in operational systems. The multi-disciplinary nature of this field has made it one of the challenging and interesting areas for researchers in OM and other related fields [125]. Some of the main areas in operations management include project management and new product development, production management, inventory and supply chain management, service operations, and forecasting. Behavioral operations management attempts to incorporate the role of humans and their characteristics in operational decisions in order to improve the quality of organizational decision making and performance.

OM models have traditionally had several characteristics that are based on the assumptions of hyper-rationality. Based on these assumptions, individuals: 1) focus on their self-interest and their main purpose is to maximize their personal profits, 2) make decisions in a completely conscious and informed way, 3) have access to all the required knowledge and information and make decision based on them, and 4) try to find the optimal solution when they make decisions [126]. What happens in reality is that individuals do not act based on these assumptions when facing problems in operational systems. In behavioral operations management, such hyper-rationality assumptions are challenged and factors such as emotions and feelings, stress and fatigue, learning, personal relationships and interdependence are considered. Considering these factors can help in better describing OM phenomena and finding
solutions to their related problems. In real world, individuals do not act based on the assumptions of hyper-rationality. Behavioral operations management first attempt to find the type of behavior that does not match with these assumptions and then, consider these types of behavior in finding solutions to operational problems.

In this paper, we discussed the key areas in behavioral operations management. Apparently, the field currently relies on a few main research areas, including heuristics and biases, bounded rationality, motivational mechanisms, feedback, and learning. There are still many opportunities to expand the literature. A wide range of studies have focused on identifying the type of decision making and behavior that deviate from the rationality assumptions. For example, one line of studies has focused on heuristics and biases that affect decisions in inventory management, ordering, and forecasting.

Furthermore, heuristics have been mainly viewed as cognitive limitation that act as a liability in decision making and behaviour. This is evident from the common use of the term "heuristics-and-biases" in BOM literature [10, 25]. However, as some researchers have argued, heuristics can be beneficial. This approach is demonstrated by the fast-and-frugal program which shows how heuristics can be as asset due to their adaptive nature [3, 127]. Adaptive heuristics result in outcomes that ensure the competitiveness and success of their users [128]. More studies are required to view heuristics from this positive perspective.

Additional studies are required to provide ways to mitigate decision making errors and improve performance in operational settings. There are a few studies on learning and feedback in areas such as inventory management [72, 73, 81]. However, the results are mixed and in some cases, the decision making biases have been robust to these intervention [88].

Regarding individual differences, cognitive abilities and rational decision making style have received most attention [36, 37, 89]. Since the main purpose of BOM research is to stay away from the assumptions of hyper-rationality, other individual characteristics need more attention. Examining the role of decision making styles such as global processing style [129], creative thinking [130], and design thinking [40] on solving operations management problems can be beneficial. These individual differences can help in solving problems in OM contexts such as project management and new product development where creativity and innovation are highly important. Stock-flow understanding is another individual ability that has a high potential for influencing problem solving in OM contexts. Operation management systems are embodiments of stock-flow systems [35]. Future studies are required to examine the effect of stock-flow understanding on performance in different OM contexts.

References

[40] Dunne, D. and Martin, R.. Design thinking and how it will change management education: An interview.


[67] Schultz, K.L., Juran, D.C. and Boudreau, J.W.. The effects of low inventory on the development of pro-


[95] Milliman, R.E.. The influence of background music


[123] Repenning, N.P. and Sterman, J.D.. Nobody ever gets credit for fixing problems that never happened: creating and sustaining process improvement. Cali-


ARTICLE

Do Stress and Anxiety Impact Memory? An Exploratory Portuguese Study

Laura Alho¹,²,³* Pedro F. S. Rodrigues⁴ Cátia Fidalgo¹

1. EPCV, Lusófona University of Humanities and Technologies, Lisbon, Portugal
2. HEI-LAB, University of Humanities and Technologies, Lisbon, Portugal
3. COPELABS, University of Humanities and Technologies, Lisbon, Portugal
4. School of Psychology, University of Minho, Braga, Portugal

ARTICLE INFO

Received: 5 June 2019
Accepted: 30 July 2019
Published Online: 30 October 2019

Keywords:
Memory errors
Testimony
Stress
Anxiety
Forensic psychology

ABSTRACT

Eyewitness memory is widely studied in the forensic context, due to their proneness to make unreliable testimonies. Understanding which factors may impact memory is determinant to avoid wrongful convictions in court. In this exploratory study, the relation between stress and anxiety and memory errors (spontaneous and induced) was analyzed being hypothesized that negative emotions may impair memory performance. Crime and neutral videos were presented to 80 volunteer university students in a between subject-design. They were asked to fill some stress and anxiety scales throughout the experimental task, as well as a free recall task. Also, it was presented several questions about the videos in which spontaneous and induced errors were assessed. Results suggest that stress and anxiety did not influence the quantity of memory errors for both genders. However, overall memory performance was poor for both conditions. Our results were discussed in light to existing theories about the relation between stress-anxiety and memory.

1. Introduction

The relation between psychology and justice emerged in the nineteenth century after several cases of people who were wrongfully convicted for crimes they had not committed. Most of these unfair convictions were caused by eyewitnesses’ identification mistakes and false testimonies although they believed they were telling the truth [1, 2].

In the absence of physical or other incriminating evidence, witnesses are fundamental in court since their testimony may be crucial for the judge's decision-making [3, 4, 5, 6]. Nevertheless, memory itself is fallible because it can be contaminated, adapted or lost, leading to either an erroneous reconstruction of the events [7] or the recalling of events that never happened, so called false memories [8, 9].

False memories can be formed spontaneously or can be implanted. During the acquisition/coding process, one can acquire, storage and recalling the information in a biased way attending to social beliefs, experience and expectations of the individual [10]. On the other hand, false memo-
ries may be created by the suggestion of others \cite{11}. When someone experience a specific event, and subsequently provide misleading information about that same event, people end up making mistakes when reporting what they have seen or experienced \cite{19, 12}. This phenomenon, known as the misinformation effect, has been tested in several investigations and consists of presenting the original event, introducing new events that are not related to the original, followed by a memory test \cite{13, 14, 15}.

Importantly, when a crime occurs, there are central and peripheral details that are memorized. Central details are considered extremely important from the legal point of view, since they refer to the physical characteristics of the perpetrator. However, peripheral features must also be considered as they may provide details that are relevant \cite{16}. The central details are associated with the anxiety-producing event (crime), in particular the physical characteristics of the perpetrators and the victims. The peripheral details, however, refer to what goes on around the event, that is, the details of the environment and the situation or action itself \cite{11}. When a witness is asked to remember the details of the event, it is usually best remembered the central details while the peripheral details are more prone to disinformation or distortion \cite{17}.

Although false memories and memory errors are two related topics, we will focus in the last ones. Memory errors refer to incorrect recall for specific information of occurred events by internal and/or external factors \cite{18}, such as stress and anxiety. Some authors suggest that stress and anxiety impair the memory of eyewitnesses, which leads to a less efficient performance \cite{19, 20} since increased anxiety is significantly correlated with increased error in the description of the event \cite{21}.

Although it is found that an event with a high negative emotional load allows an improvement to central details than peripheral ones, individuals still commit many errors in the offender identification \cite{22}. Other investigations show opposite results, reporting an improvement in memory in stressful and emotionally arousing events \cite{23, 24} and that these variables improve the performance of witnesses for details \cite{25}. In these situations, an anxiety and stressful context may allow individuals to become more attentive to what is going on in their surrounding environment, assimilating more details \cite{25}.

When a person witnesses a crime, s/he experiences more or less levels of stress \cite{26}. Stress can be defined as a negative emotional state, associated to physiological changes that are related to the increase of the arousal and consequent increase of the heart rate, blood pressure and contraction of the muscles, as to a subjective set of cognitions, that is, of thoughts \cite{26, 27}.

Another relevant variable is anxiety, which can be classified by state-anxiety and trait-anxiety. Anxiety-state is characterized by a transient emotional state that includes unpleasant feelings of tension and conscious apprehension due to increased activity of the nervous system; on the other hand, trait-anxiety is related to the individual differences of each person, which are relatively stable \cite{28, 29}. Although anxiety arises frequently as a response to stress, these concepts are distinct. While anxiety is an adaptive response, overcoming certain thresholds becomes pathological \cite{28}, stress arises as a response to a specific event \cite{26}. Roberts \cite{10} found that anxiety mainly affects the memory of individuals who have low trait-anxiety levels and who in crime contexts present high levels of anxiety. However, individuals who have high levels of trait-anxiety and trait-anxiety, are more developed with strategies to deal with anxiety. This raises the question that individuals with low levels of trait-anxiety, in emotional contexts that elicit high anxiety, are more likely to create more errors, contrary to others that do not have strategies to deal with anxiety.

Anxiety may be present, not only during the crime, where the subject encodes the information of the event, but also at the interview made by the police where the witnesses have to share the details that s/he remembers of the event \cite{19, 31}. It is also relevant to pay attention to the type of questions made in order to avoid the increment of the anxiety in the witness and the disruption of her/his memory.

Similarly, in crime contexts and concern to gender, Aréh \cite{32} found that women are more reliable eyewitnesses when compared to men, since they are more accurate in the descriptions of the offender. Men are more confident in their responses to the details of the location, that is, where the crime occurred. Effectively, women seem to have better overall memory for crimes by performing significantly more accurately than men on recalling the event, as well as they are more effective in the description of perpetrators, even when the perpetrator is a woman \cite{13}.

Despite the diversity of studies related to memory errors, there is still a lack of consensus regarding the effect of anxiety and stress in memory. In fact, some studies reported that these variables are beneficial in the recalling of the events, while others mention an opposite pattern. This study intends to verify if a situation that produces anxiety and stress influence the production of spontaneous and induced errors (hypothesis 1). Participants were divided by gender to evaluate the quantity and quality of memory errors, expecting woman to have a better performance compared to men (hypothesis 2).
2. Method

This experiment was approved by the Ethics Committee of the Lusófona University of Humanities and Technologies, Portugal. Moreover, the guidelines of the Declaration of Helsinki and the standards of the American Psychological Association were followed.

2.1 Participants

Eighty-two university students with accurate or corrected vision (42 men aged between 18 and 58 years, Mean (M) = 23.2, Standard Deviation (SD) = 6.2, and 40 females aged between 18 to 42 years, M = 22, SD = 4.3) from Lusófona University of Humanities and Technologies volunteered to participate. Two participants were excluded for not complete the questionnaires.

2.2 Instruments and Materials

The State-Trait Anxiety Inventory (STAI; Portuguese study) [34] was used to assess participant’s anxiety. This is a self-response scale which consists of two subscales with twenty items each (STAI-Y1 to measure state-anxiety and STAI-Y2 to measure trait-anxiety). The responses are provided by choosing one of the four options (1-4 points); The total score of each subscale ranges 20 (minimal anxiety) to 80 points (maximal anxiety). The Portuguese validation study (age-range: 15-69 years old) revealed good psychometric properties, such as a good Cronbach alpha (≥ .87). This inventory is widely used and it allows to assess the two dimensions of anxiety (state- and trait-anxiety).

To assess participants’ subjective stress levels, a Visual Analogue Scale (VAS) was used ranging from 0 (not stressed at all) to 100mm (very much stressed).

Four videos, two of crime (hostage robbery and domestic violence) and two neutral (a couple walking by the sea and a team of photographers working in a historic city) were randomly presented.

For each video, a set of six questions was applied: five without misleading information and one with misleading information in order to assess spontaneous and induced errors.

2.3 Design and Procedure

Three pilot studies were conducted. The first pilot aimed the videos selection for the experiment (n = 10). Alho and colleagues [35,36] have developed several studies exploring the nosewitness (psychology of testimony) and the authors used five videos of crime and five neutral scenes. For this experiment, a panel of ten independent raters (5 men, aged between 20 and 31 years, M = 24.5, SD = 2.8; and 5 women, aged between 19 and 30 years (M = 25.2, SD = 3.1)) rated all videos from the studies of Alho and collaborators in 5-point Likert scales in terms of vividness, arousal and pleasantness. The two crime videos rated as more vivid (crime video #1, M = 4.6; SD = 0.5, crime video #2, M = 4.0, SD = 0.5), arousing (crime video #1, M = 4.7, SD = 0.5; crime video #2, M = 4.5, SD = 0.5) and unpleasant (crime video #1 M = 1.2, SD = 0.4; crime video #2, M = 1.6; SD = 0.7) were selected to the emotional condition (experimental group). The crime video #1 is a situation of taking hostage with the robber being killed by the police. The video #2 shows a domestic violence situation in which a man assaults a woman to try to get her out of the car. The two neutral videos rated with less arousing (neutral video #1, M = 2.0; SD = 0.7, neutral video #2, M = 1.8, SD = 0.4) and medium pleasantness (neutral video #1, M = 3.0; SD = 0.8, neutral video #2, M = 2.5, SD = 0.5) and vividness (neutral video #1, M = 3.3; SD = 0.7, neutral video #2, M = 3.6, SD = 0.5) were selected to the neutral condition of our experiment. The neutral video #1 is a couple walking by the sea and the neutral video #2 is a photographic team working in an historic city. These neutral situations are based on daily life and the intent is to not provide emotion or arousal.

The second pilot study (n = 10) was performed in order to select the questions that might increase suggestionability and create spontaneous and induced memory errors (misleading information). Six questions were created for each film: five without misleading information (spontaneous errors), and one key-question with misleading information (induced errors). In each question, participants had the possibility to respond with Yes, No or Don’t know. Ten participants (5 men between the 19 and 28 years (M = 24.2, SD = 2.6) and 5 women between 19 and 32 years (M = 26.2, SD = 4.1) visualized each of the four selected videos and wrote all the things they remember from the scene (crime and neutral). In order to later be able to compare the amount of details remembered and reported by the participants, an information matrix was elaborated by the researchers, considering all the peripheral and central details. The details mentioned by all the participants in this pilot were selected to create the questions.

A third pilot study was conducted, in which three university students performed the task to test the procedure. None of the participants in the pilot studies have performed the experimental task to avoid any expected biases.

In a between-subject design, participants (n = 80) were randomly assigned to one of the two conditions: emotional (crime) and neutral scene. Participants filled a questionnaire with sociodemographic data, as well as STAI-Y1.
and Y2 [29] and VAS [37].

Participants were informed that they would watch a real video using headphones, since visual and auditory cues promote greater ecological validity and increment the emotional tone of crime videos. Sound volume and video resolution were constant for all participants.

The videos were presented on a TOSHIBA Satellite computer (L850-1P9) of a 15.6-inch monitor. All the presented videos had an average duration of 60 seconds. A fifteen-minute retention interval (RI) was followed. After the video participants were asked to fill the VAS (stress) and STAI-Y1. In order to fulfill the 15-minute RI, they were also asked to complete the Thinking and Creating Styles Scale [38]. The results of this scale will not be presented, since it was used only as a distractive task.

Subsequently, participants performed a free recall task [39]. In this task, participants were instructed to report all the details they remember of the video they watched. After, participants were given a questionnaire about the video to determine the production or not of memory errors. Finally, participants were asked to complete the stress and anxiety scales to ensure that none of the participants was in distress.

3. Results

For the statistical analysis, the IBM SPSS Statistics 22.0 was used. ANOVAs, chi-square tests, independent and paired t-tests, and Pearson correlations were performed.

3.1 Stress and anxiety levels

Mixed repeated measures ANOVA was performed for the stress levels between the three moments (before/beginning of the task, after the video/post-film and at the end of the task). We verified an interaction between the stress and the nature of the films (crime vs. neutral), F(2,156) = 10.57, p <.001. Since there was an interaction between the stress and the condition of the film, paired t-student tests were performed for each condition. In the crime condition, post-film stress was higher compared to the stress levels in the beginning of the task and this difference is statistically significant, t(39) = 3.76, p < .001. There was also a difference between the stress levels in the beginning of the task and the stress levels at the end of the task with this difference being statistically significant, t(39) = 3.73, p < .001. This means that crime videos increased participants’ stress levels, as expected, by their emotional nature.

Regarding the neutral condition, there was a marginal statistically significant difference, t(39) = 2.03, p = .05, between the stress levels at the beginning of the task and the stress levels at the end of the task. However, although stress levels have increased throughout the experimental task, they were not high. Therefore, neutral videos did not trigger emotional reactions, which was expected. See Table 1 for descriptive values.

Table 1. Means (and SD’s) obtained in the VAS (Stress) by video condition, in the following moments: before the task, after the video, and at the end of the task

<table>
<thead>
<tr>
<th>Video Condition</th>
<th>Before the task</th>
<th>After the video</th>
<th>End of the task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime condition</td>
<td>1.74 (2.24)</td>
<td>2.98 (2.81)</td>
<td>2.44 (2.41)</td>
</tr>
<tr>
<td>Neutral condition</td>
<td>2.20 (2.54)</td>
<td>1.92 (2.24)</td>
<td>1.77 (2.02)</td>
</tr>
</tbody>
</table>

Mixed repeated measures ANOVA was performed for the state-anxiety and trait-anxiety. There was an interaction between anxiety-state and the nature of the films, F(2,156) = 3.32, p = .04. As so, paired t-student tests were performed. In the crime condition, there were statistically significant differences between the initial state-anxiety (M = 33.88; SD = 7.80) and the post-film state-anxiety (M = 37.58; SD = 9.91), t(39) = 3.37, p = .02. In the neutral condition, there were no statistically significant differences in state-anxiety in any of the three moments (p ≥ .05). Concerning trait-anxiety there were no statistically significant differences (p ≥ .05), nor was there a significant interaction between state-anxiety and the nature of the videos (neutral and crime).

Thus, results suggest that after visualizing the crime videos the levels of state-anxiety and stress increased significantly, but trait-anxiety levels were maintained, since the trait is a relatively stable individual characteristic. See Table 2 for descriptive values.

Table 2. Means (and SD’s) obtained in the state-anxiety and trait-anxiety by video condition in the following moments: before the task, after the video, and at the end of the task

<table>
<thead>
<tr>
<th>Video Condition</th>
<th>Before the task</th>
<th>After the video</th>
<th>End of the task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime condition</td>
<td>33.88 (7.80)</td>
<td>37.58 (9.91)</td>
<td>35.70 (10.65)</td>
</tr>
<tr>
<td>State-anxiety</td>
<td>36.90 (9.52)</td>
<td>36.80 (10.71)</td>
<td>36.25 (11.61)</td>
</tr>
<tr>
<td>Trait-anxiety</td>
<td>35.90 (9.98)</td>
<td>35.90 (9.47)</td>
<td>34.57 (7.51)</td>
</tr>
<tr>
<td>Neutral condition</td>
<td>37.32 (11.01)</td>
<td>36.48 (10.58)</td>
<td>35.92 (10.28)</td>
</tr>
</tbody>
</table>

Pearson correlations between the stress levels at the beginning of the task, after the video and at the end of the test and memory errors were performed. The correlations were not significant (p ≥ .05). The same analysis was done for state-anxiety, trait-anxiety and memory errors and there were no significant correlations (p ≥ .05), suggesting

DOI: https://doi.org/10.30564/jpr.v1i3.894
that there is no correlation between stress and anxiety with memory errors.

3.2 Spontaneous Errors

Each participant visualized a video and had to answer questions about it. Each questionnaire had six questions and one of them was an error-inducing question, with misleading information, while the other questions had no misleading information (to assess spontaneous errors).

Regarding crime video #1 (hostage robbery), in the error-inducing question, 30% of the participants had a memory error, i.e., they assume the information integrated in the question was right, and 55% of participants preferred to answer "don't know". However, the greater percentage of errors (40%) was observed in a question without any misleading information (spontaneous errors).

Regarding the crime video #2, it was found the same percentage of memory errors compared with the first crime video (30%), but it was observed a higher percentage of correct answers (45%). Results showed spontaneous errors in every question, varying between 10 to 30%.

In the neutral video #1, results showed that 15% of participants assumed the misleading information as correct. However, it was in a regular question, without misleading information that participants presented more errors (40%).

Finally, in the neutral video #2, results showed the same percentage of errors as in the neutral video #1 (15%). Moreover, the highest percentage of spontaneous errors was 30%.

A Chi-square test was performed and results showed more errors in the crime condition compared to the neutral condition with respect to the questions with misleading information, with this difference being statistically significant, $\chi^2(2) = 6.109, p = .047$.

With regard to the free recall task, paired t-student tests were performed to compare means in recalling central and peripheral details within the two conditions. In the crime condition, there were more central details remembered than in the neutral condition, with this difference being statistically significant, $t(78) = 4.076, p < .001$. Moreover, in the neutral condition, the peripheral details were more remembered than in the crime condition, but this difference is not statistically significant ($p \geq .05$). See Table 3 for descriptive values.

### Table 3. Means (and SD’s) for central and peripheral details recalled by participants in each condition

<table>
<thead>
<tr>
<th>Details</th>
<th>Crime condition</th>
<th>Neutral condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central details</td>
<td>3.78 (2.14)</td>
<td>2.09 (1.51)</td>
</tr>
<tr>
<td>Peripheral details</td>
<td>2.73 (1.22)</td>
<td>3.19 (2.46)</td>
</tr>
</tbody>
</table>

3.3 Sex Differences

No statistically significant difference was found between men and women regarding the stress and anxiety levels ($p \geq .05$).

To verify if there were differences between women and men for the misleading questions, chi-square tests were performed. The results showed that men made more induced errors than women. This difference was statistically significant, $x^2(2) = 6.627, p = .036$.

In the neutral condition, results showed no significant differences in the performance of men and women, $p \geq .05$.

Regarding the free recall task independent t-student tests were performed to compare the differences between gender with the central and peripheral details, considering the two conditions. For the crime condition no significant difference was found between men and women in the recall of central and peripheral details ($p \geq .05$). In the neutral condition, women reported a greater number of peripheral details compared to men, a marginal statistically significant difference ($p = .05$).

4. Discussion

Memory is fallible and that is the main reason why innocent people are wrongful convicted. In the present study we aimed to determine if there was an influence of stress and anxiety on memory errors using real scenes.

We hypothesized that high stress and anxiety levels compromise memory, leading to more errors. However, there was no relation between stress and anxiety levels with memory errors. Our results do not support the idea that stress or anxiety have a positive or negative impact on memory. In fact, the results obtained were not in agreement with the existing literature which, in one hand, shows the negative influence of these variables on the memory errors [19, 20], and in the other hand, that stress or anxiety may improve the memory of witnesses, because individuals are usually predisposed to be more attentive to what is happening [22, 23]. Our results maintain the debate about the impact of these variables in recalling events with emotional content.

Although there was no relation between these variables with spontaneous and induced errors, it was observed, through VAS, that events with a negative emotional tone (crimes) triggers stress, that is, after seeing crime videos the stress levels increased. This result is congruent with the literature that states the existence of high levels of stress when witnessing a crime [24]. However, for the neutral condition there were no significant changes, only a slight change was observed between initial and final stress.
For state-anxiety, the results of STAI-Y1 scale showed a significant increase after viewing the crime videos. Contrary to stress and state-anxiety, in STAI-Y2 (trait-anxiety) no significant differences were observed. This can be explained by the fact that it refers to an individual characteristic that is relatively stable [28, 29], with no changeability during the experimental task.

Although there was no influence of stress and anxiety in memory, there were spontaneous and induced errors in the questions about the videos. While there was a high percentage of errors in the questions that had misleading information (induced errors), it was in the questions without misleading information that there was a greater percentage of errors (spontaneous errors). Participants were also given the chance to respond, “don’t know”, and these answers were not counted as errors. As a rule, when participants have closed-ended questions (yes/no), they end up spending more time thinking about this issue and may end up believing it to be a truth and making more mistakes [40]. The answer "don’t know" does not force the participant to have to decide on the truth or falsity of an information, thus avoiding false positives. This methodology has been done in memory and offender recognition studies, both through interviews and through lineups [22, 41]. When we compare the questions with misleading information in both conditions, results revealed that the number of errors was significantly higher in the crime condition, according to the expected, that is, a crime situation adversely affects the memory of the participants [43].

In the free recall task, participants in the crime condition remembered more central details compared to the neutral condition. This might be explained by the literature confirming that there is an improvement in the memory of central details in crime contexts rather than neutral ones, because emotionally arousing contexts improve recall of physical characteristics of the offender and the victims [23, 24]. This is due to the negative emotional charge that causes a high focus of attention, which leads to an increase in the details [21]. Although we have found no statistically significant differences, it should be noted that participants in the neutral condition recalled more peripheral details compared to those who viewed crime videos, guiding their attentional focus to the surrounding environment.

The details remembered by the participants were far below expectations when compared to our matrix. This allows us to conclude that the participants’ memory was weak in a short retention interval (15 minutes). However, in real context, the retention interval is usually considerably greater. It can often take years for a witness to be called to testify. The literature points to a decrease in memory with longer retention intervals [3]. This expectation may lead witnesses to provide biased information because of the degree of emotion in coding, at recall [2], and because witnesses tend to fill memory gaps that occur over time [3].

Regarding gender, in the free recall task, there were no relevant differences in the crime condition for details remembered by men and women. However, the responses given by the participants about the videos showed significant differences between men and women, in the crime condition, with men evidencing more errors. These results are in line with the existing literature that women have a better memory in crime context compared to men who give more errors [33, 45]. Although it has not yet been well established, women can present a more accurate memory in crime contexts, because they are also the victims of crimes [33].

One of the criticisms of laboratory eyewitness studies is the use of videos that may not generate the same levels of arousal and anxiety as when experiencing a real crime situation [24]. Witnessing a traumatic event causes more impact than the visualization of a real event in a laboratory context. Nevertheless, this experimental study allowed to verify that there is an effective increase of the levels of stress and anxiety in a negative emotional event.

According to the literature, people remember more central than peripheral details when they experience a crime situation. This confirms that experiencing negative events may compromise the accuracy of the testimony [46].

Even though there was no correlation between stress and anxiety with the errors made by participants, these variables, when experienced at high levels, can compromise memory. The increase of errors in the description of the event is related to increased anxiety [21]. Anxiety and stress are experienced not only during the crime, when acquisition / coding is done, but also at the time of recovery at the interview [19, 31].

Given that eyewitnesses’ mistakes have a great impact in judicial and societal domains, further investigation is needed in order to decrease these errors that may have serious repercussions.

References


REVIEW

Analysis of the Concept and the Drama Psychology of Immersive Theatre

Xinyue Wang*
School of Literature, xianlin Campus, Nanjing University, Nanjing, Jiangsu, China

ARTICLE INFO

Article history
Received: 30 August 2019
Accepted: 3 September 1 2019
Published Online: 30 October 2019

Keywords:
Immersive theatre
Sleep no more
The concept of theatre
Psychology of audience

ABSTRACT

Immersive theatre means put audience into the space where the story take place. Actors and actresses perform in the authentic environment and audience also in this environment, watching the proceeding of the story closely. With the success of Sleep No More, more and more people pay attention to immersive theatre. Some Chinese theatre directors also launch out into doing similar things. It is no doubt that immersive theatre is popular now at home and abroad. However, as a new form of theatre, immersive theatre theoretical study is really inadequate. This text aims explain the connotation and concepts of immersive theatre or what is immersive theatre, the feature of immersive theatre in addition to its present situation in China, though Sleep No More, one of the most famous immersive theatres. I hope to offer reference for Chinese theatre people, make contributions for their study and creations, then again filling in gaps in immersive theatre theory. Only in this way, can immersive theatre develop healthily and can its ecology be constructed well.

P.C. 210046

1. Theatre of Cruelty and Environmental Theatre: Theoretical Source of Immersive Theatre

The ideas advocated by immersive theatre and theatre of cruelty have obvious similarities.

Just as Artaud mentioned in the article, “The Cruel Theatre (First Declaration)” that theatre should be restored to its original form, that is, to become a true illusion means, it must provide the audience with a real deposit of theatre We canceled the stage and theater hall and replaced it with a unique place, no partitions, no fences, and it was the place where the plot happened [1]. A direct communication will be established between the watching and the performance, the actors and the audience, as the audience is at the center of the performance and is surrounded and permeated by the performance. This kind of encirclement comes from the shape of the theater itself. The environmental theatre advocated by the theatre master Schechner also emphasizes the communication between the actors and the audience . The main feature of environmental theatre is the participation of the audience. Schechner believes that the participation of the audience expands the scope of the performance, and broken the performance and make it become social activities. Sometimes audience participation is spontaneous; sometimes even completely unexpected; sometimes it is the effect of director [2].

The immersive theatre puts the audience directly into

*Corresponding Author:
Xinyue Wang,
School of Literature, xianlin Campus, Nanjing University, 163 Xianlin Avenue, Qixia District, Nanjing, Jiangsu, China;
Email: 11833846@qq.com
the environment where the story takes place, blurring the line between the performance environment and the real environment, and is in line with the theatre of cruel advocated by Artaud. At the same time, the immersive theatre also pays attention to the audience participation. The distance between the actors and the audience is reduced, the audience can observe the actors in a short distance, and even participate in the performance with the actors, which has something in common with the environmental theatre.

2. Concept Miscellaneous: Immersive Theatre Urgent Needed to be Clearly Defined

In “Immersive Theatres”, Josephine Machon describes immersive theatre as “practice which actually allows you to be in ‘the playing area’ with the performers, physically interacting with them. The direct participation of the audience member in the work ensures she or he inhabits the immersive world created.” In this statement, the author emphasizes the space breakthrough between the performances, through which the immersion is achieved.

In “On Immersive Theatre”, Gartheth White said “It has theatrical elements, dialogue with in-role facilitators organizing the event and the gesture of surrendering oneself to a clinical/experimental/sacricial process, but it also use of a physical interior, engages the whole body of the spectator participant, and creates an ambiguous situation whereby it is unclear whether the work is happening around, to, or within the spectator participant. This definition is more abstract, but essentially emphasizes the communication between the audience and the actors.

In China, scholars defined immersive theatre more simple: “immersive means make audience surrounded with the environment where the story taken place.”

As a new trend, there are many ambiguities in the concept of immersive theatre whether it is abroad or domestic. The challenge with this debate, with all of its kind, is how you define your terms. Are we all going to be speaking about the same thing? Terms such as immersive, intimate, epic, can all be slippery in the context of trying to find common ground or some kind of shared truth.

In my opinion, immersive theatre need to meet the following conditions.

First, the audience used to be a passive viewer of the performance. But now they have initiative, no longer what the actor plays, what the audience must to see, but the right of choosing what they prefer to watch. The freedom of choice means equality. This choice puts the audience and actors in an equal position and is the psychological basis for the audience to “immersive”.

On such a psychological basis, the immersive theatre also needs to break “the fourth wall” and let the audience participate in the theatrical performance. Audience participation is a major feature of immersive theatre which makes it different from traditional drama. In traditional drama, there is also a two-way communication between the audience and the actors, but because of the fourth wall, the audience can only receive aesthetic experience. Even it is a tragedy performed on the stage, the audience will not suffer, they often get “katharsis” because of the lofty spirit of tragedy. Aesthetics requires distance, traditional drama gives enough distance to weaken the emotions of the drama itself, and allows the audience to think rationally. But on immersive drama, “the fourth wall” was broken and the distance between the performance and watching was greatly reduced, so the immersive theatre can give the audience more emotional stimulation. How much influence can a play have? Sometimes it depends on the audience’s participation. In some real scene such as “Impression Lijiang Show” (a show directed by Zhang Yimou and performed in Lijiang Scenic Area), audience can watching show in the place where story happen, but they don’t play any role in the show. Some immersive theatres let the audience play the characters in the play directly. Compare the two forms, it is obvious that audience can get different feelings.

Based on this, I think that the immersive theatre should have the meaning of both broad and narrow sense. Broadly speaking, as what we discussed above, all the dramas that give audience initiative to break “the fourth wall” and drop audience into the environment where story taken place can be called immersive theatre. In a narrow sense, immersive theatre should guarantee the participation of the audience. The audience can participate in the plot, and the ability to obtain a personalized experience is called immersive theatre.

3. The Predominant Status of the Audience: the Research of Audience’s Psychology

In theatre discourse ‘immersive’ is now attached to diverse events that assimilate a variety of art forms and seek to exploit all that is experiential in performance, placing the audience at the heart of the work. In traditional theatrical performances, the audience sit in the auditorium and watched the performances on the stage. The actors hoped to make the audience enter the plot through their own performances. However, the fixed seats and stationary scene made the audience only “watch the show”. In an immersive theatre, the audience can watch a play in their own way. The audience is actually “felt”, and everything the actor does is helping the audience perceive the scene.
Take *Sleep No More* as an example. When you first enter the theater, there will be several staff members in black who tell you: “Walking along the wall, turning when needed.” The entire aisle has no light with strange music, and perception begins at this time.

There were many one-on-one performances throughout the performance. Here I’d like to take the one-on-one plot in the fifth-floor psychiatric hospital of the McKinsey Hotel as an example. The woman who drunk the red wine was caught in the ward by the nurses. The nurse invited two audience to enter the ward and closed the door. The doctor in white coat walked over and put a white sick suit on the audience and direct the audience to the bed. This time the audiences played the role of the crazy woman’s roommates. When the doctor took the pulse for the patient, the mad woman broke away from the doctor and nurse, and hid under the bed with the audiences, seeing the doctor and nurse walking around. In the end, the mad woman was pulled out of the bed by the doctor. The performance continued stay under the bed and watch the dance of the mad woman. The lights in the ward were twinkled and the action of the mad woman was freezed. In this performance, although the audience is still passively accepted, the subjective status of the audience is established: the closed door, the actors around the audience, all this tell the audience that all we have done is for you.

**4. Scopophilia: the Tendency of Cultural Activities**

Catering to the desire of audience is the essential purpose of entertainment. We are passionate about watching movies, not only because these entertainment activities bring us joy, but also because they satisfy our desire to “see other’s life”.

The word “scopophilia” used to be applied in theory, but now can be used to explain the pleasure of immersive theatre that audience acquired during the performance. When watching a movie, through the changing scene, the audience can easily be brought into the story and become a legitimate voyeur. The drama is also satisfying the audience’s viewing, but always at a far distance. The viewer’s sight is stationary, and the audience always sees the entire stage.

In the immersive theatre, the audience’s scopophilia is greatly satisfied. The audience and the actors are in the same space-time. Audience can sit next to actors, carefully observe the actors’ expression in a short distance, or enter the actors’ bedroom and read the actors’ letters. *Sleep No More* immerses its audiences in a paradoxical practice: we write our individualized plotlines in our own movements, but are constructed within the spectacle as realist voyeurs, watchers, and readers, not agents.

While satisfying the voyeur of the audience, the immersive theatre also satisfies the pleasure of the audience being seen. In the traditional theater stage, the actor is the performer and the audience is the viewer. In the immersive theatre, the audience is not only watching the performance, but also being seen by the actors, and by the other audiences. In “Double” (an immersive theatre directed by Tong Tong and play in Shanghai Theatre Academy in 2016), the audience also acts as a character in the play, becoming one of the actors. The double satisfaction of seeing and being seen makes the audience get psychological pleasure throughout the process.

Meeting the audience’s scopophilia is also a direction for the development of contemporary cultural industry. Such as the escape of the secret room, the theme park, and the prevalence of various experience museums are also designed to meet the audience’s satisfaction. Catering the audience’s scopophilia is a gradual process. With the development of social economy, people’s emotional threshold is getting higher and higher, and become more difficulty to be satisfied. Before the advent of modern electronic devices, people usually relied on books and traditional dramas to watch others perform a glimpse of other people’s lives. Now can be used to explain the pleasure of immersive theatre also satisfies the pleasure of the audience being seen. In the traditional theater stage, the actor is the performer and the audience is the viewer. In the immersive theatre, the audience is not only watching the performance, but also being seen by the actors, and by the other audiences. In “Double” (an immersive theatre directed by Tong Tong and play in Shanghai Theatre Academy in 2016), the audience also acts as a character in the play, becoming one of the actors. The double satisfaction of seeing and being seen makes the audience get psychological pleasure throughout the process.

For actors, immersive drama is challenging. There has never been an art like an immersive theatre that emphasize watching. Actor know that the audience looking at them in a short distance. Every expression on their face will be magnified. Sometimes being seen will bring pleasure which can inspire the potential of their performance.

**5. Prospect Analysis of Immersive Theatre**

Any discussion is for the development in the future, the same as immersive theatre. There is no doubt that immersive theatre has a broad space for development in the future. The tendency can be seen from the popularity of the “sleep no more”.

The immersive theatre breaks the traditional viewing relationship and immerses the audience in the drama to stimulate the audience’s more emotional experience.
Nowadays, people want more immersive experience in entertainment. It’s related to the “experience economy”. 3D movies, VR technology and Li An’s 120 frames per second film which called “Billy Lynn’s long halftime walk” all represent the tendency. In contrast, the biggest advantage of immersive theatre is reality. It is not through computer technology that makes the audience feel real, but everything is truly in front of you, not only visible, but also sensible.

At the same time, the immersive theatre also represents a deep class dissolution. Every chair in the modern theater is equal. In the immersive drama, there are no longer different ticket files. From the moment you bring the mask into the theater, you and the other audiences no longer have any difference. “The hallmark of the theater is the transformation, transforming the stage into a drama space, transforming the actors into roles and turning the guests into audiences.” The transformation of the immersive theatre is exhaustive, and the audience forgets themselves and immerses in the theatre in two hours. You are a part of the performance as well as other audience.

But the form of immersive theatre itself has some problems. First of all, watching is the most prominent problem. In the traditional theater, the audience is orderly, and the stepped theater design allows the audience to see the whole performance without being obscured even if they are sitting in the back row. Immersive theatre emphasizes the communication between the audience and actors, but often leads to the disorder. Imagining this, in a small corridor, if there is a viewer who is taller than you stand in front of a viewer all the time, what kind of feeling do you have? Therefore, it is important to bring new rules and regulation to immersive theatre. Because only in this way, can we make the audience “immerse” and improve the audience’s viewing experience. Perhaps by limiting the number of visitors to each performance, perhaps designing the walking route of the audience in advance, or by increasing the number of actors and the capacity of the entire theatre, and so on.

Secondly, the means of immersive theatre to make the audience “immerse” mainly depends on external things, such as set, props, music, etc., although there are also actors who invite the audience to perform one-on-one performances to make the audience join the drama, but after all, The audience who can be invited to experience one-on-one performance is a minority. They are not enough to make the audience immerse. At this point, “Double” and “Hideout” (A drama directed by Pavel Pasini and Polish Net Theatre may be good demonstrations. In the “double”, the audience directly plays the characters in the play, and as the story develops and the actors take place, the truth of the matter is explored. And “hiding” works hard on the set, the audience needs to go through the underground passage covered with spider webs, and hide in the basement with the actors, the audience has the same fear as the actors. This fear will enable the audience to better understand the situation of Jews during World War II, and better understand the reasons behind the choice of silence.

Last but not the least, no matter how the external form of drama develops, the story is always the inner core of a drama. The immersive theatre is often fragmented and loose in narrative and plot. As a new trend, the audience is attracted by the unique expression of immersive theatre, but once it becomes common, the audience is already very familiar with this form of expression, whether it is still attractive to audience? While continually exploring new forms, immersive theatre also need to focus on the core of the story. How to integrate a moving story with emerging forms is perhaps a question that deserve all directors to think about.

References
ARTICLE

Differences on Information Commitments in Consumption Domain

Hung-Ming Lin*

Minghsin University of Science and Technology, Taiwan

ARTICLE INFO

Article history
Received: 25 April 2019
Accepted: 17 September l 2019
Published Online: 30 October 2019

Keywords:
Information commitments
Confirmatory factor analysis
Online shopping information

ABSTRACT

Information commitments are a profile of evaluative standards and information searching strategies on the Internet. The purpose of this study is to examine the reliability and validity of the information commitments instrument in consumption domain, and differences among scales underlying the instrument. A total of 258 university students participated in the survey who have experiences in online shopping. Using confirmatory factor analysis technical, this study has identified valid measures for each construct underlying information commitments in consumptions domain. The results indicate that participants preferred to utilize “content” to judge the usefulness of the information, and use “multiple sources” to evaluate the correctness of information, that they oriented to use search strategy “elaboration” in verifying online consumption information. Gender differences are also revealed on standard of the “multiple sources” and the “content”.

1. Introduction

The development of the Internet has increased the popularity of online shopping. Online shopping is quickly becoming a preferred way to shop for consumers [1]. Today the vast majority of consumers spend a significant amount of their time online during online purchase decision-making process. In the online purchase decision-making process, consumers gather and evaluate consumption information after need recognition stage [2, 3]. Although the Internet empowers consumers, there is a paucity of systematic conceptual or empirical research indicating how consumers search the information, and evaluate the information they gathered [4]. Because the manner in which consumers search for, process, and use information is a complex phenomenon that is not completely understood, this study attempts to provide a portfolio of standards in evaluating and searching consumption information.

Tsai [5] proposed the idea of information commitments (ICs) which is a set of evaluative standards in which Web users utilize in order to assess the accuracy and usefulness of Web-based materials, and these commitments are also relevant to searching strategies. The ICs consist of three aspects, including standards for accuracy, standards for usefulness, and searching strategies. Each of them has two possible differing orientations. The detailed definition for each standard is presented below:

(1) Standards for accuracy of online information: The ‘multiple sources’ is to assess whether students judge the correctness of information by referring to other websites, peers, or printed texts. The ‘authority’ is to measure whether students examine the correctness of information by the reputation of the websites or sources.

(2) Standards for usefulness of online information:
The ‘content’ is to assess whether students evaluate the usefulness of information according to the relevancy of its content. The ‘technical’ is to explore students evaluate the usefulness of information in terms of the ease of retrieving, searching, and obtaining information.

(3) Online information searching strategy: The ‘elaboration’ is to investigate whether students use purposeful thinking or integrate relevant information from several websites to find the best fit that fulfills their purpose. The ‘match’ is to measure whether students intend to find the most fruitful and relevant information from a few websites to fit their purposes.

In Cheng, Liang, and Tsai study [8], ICs can be alternatively examined from two aspects: criteria (internal aspect) and strategies (external aspect). Furthermore, this study assumed that ‘multiple sources’ and ‘content’ could be classified into ‘advanced criteria,’ while ‘authority’ and ‘technical’ could be categorized into ‘naive criteria.’

Information commitment is a domain dependent. Relevant studies have showed that individuals showed various tendencies on the six scales. For example, in learning environment, Tsai [5] indicated the experts expressed ICs more oriented to “multiple sources”, “content”, while many of the college students stated ICs more oriented to “authority”, and they prefer to utilize a “match” searching strategy in Web-based environments. Take more details about information commitment toward online medical information and financial information. Liang and Tsai [7] revealed that medical students with more Internet usage experience preferred to use the “multiple sources”, “authority”, “content” and “technical” standards to assess online information, and utilize the “elaboration” strategy to find the best fit of all searching. The results also found that medical students held less advanced information commitments than general university students. In Lin, Tsai, and Hoang’s study [8], they revealed that gender differences on the financial information commitments were occurred. The female participants show higher preference in using the “multiple sources” standard for judging accuracy of financial information, and higher tendency in using “elaboration” searching strategy than male participants. Moreover, participants with more Internet usage experiences preferred to employ the “authority” standard for assessing the correctness of financial information on the Web.

In order to extend the application domain of information commitments, and understand consumers of evaluating consumption information, the purpose of this study is to examine the reliability and validity of information commitments instrument in consumption domain. Moreover, the differences among scales underlying the information commitments, and gender differences in the scales are also examined.

2. Methodology

2.1 Sample

The participants of this study included 300 volunteer university students with online shopping experiences (including 250 college students and 50 graduate students), coming from four universities. A total of 258 effective samples included in this study (150 females, mean age 20.2).

2.2 Instrument

Information commitment measurement scale was adapted from Wu and Tsai’s [9] Information Commitment Survey (ICs) measurement, 24 items were used to measure respondents’ ICs under six dimensions which included multiple sources, authority, content, technical, elaboration, and match. Each dimension had 3 to five items. Examples of items are “If these consumption information appears in the famous information page or site, I think these consumption information should be correct.”, “I will look for books or magazines related content, come again to judge these consumption information is incorrect.”, and “I used to search for many consumption information from different websites or web pages from the Internet.” Respondents are asked to respond to each questionnaire item using 7-point Likert scale, with 1 representing “strongly disagree” and 7 representing “strongly agree.” Cronbach’s α for the dimensions were 0.899, 0.789, 0.853, and 0.886, respectively (Table 1).

3. Results

3.1 Reliability and Validity

In order to test the construct validity and reliability of ICs measurement in consumption domain, the confirmation factor analysis (CFA) is used with LISREL8.8 software in conducting data. In general, a sample size of at least 200 observations would be an appropriate minimum for CFA analyses [9]. Therefore, the sample size of 259 was sufficient for the CFA of ICs in this study.

The results showed, the measurement model had acceptable fitness to the data ($\chi^2=337.12$, $\chi^2$/d.f. =0.976 < 2, RMSEA=0.068<0.08, GFI=0.921>0.90) [10,11]. Table 1 presented that each item loadings are higher than 0.7 threshold value 0.7 as proposed by Chin [13], the values of the Composite Reliability (CR) for each construct above 0.7 standard 0.7 as proposed by Henseler, Ringle, and Sinkovics [14], and the values of the Average Variance Extracted (AVE) for each construct is greater than standard.
0.5 as proposed by Fornell and Larcker [15], therefore convergent validity of the ICs was verified through acceptable factor loadings, CR, and AVE. The assessment of discriminant validity was based on the Fornell and Lacker [15] criterion which refers to the square root of each construct’s AVE should have a greater value than the correlations with other constructs. To examine the discriminant validity, as shown in Table 2, all the diagonal value in bold is greater than the values in its row and column, thus the discriminant validity was also achieved [15].

Table 1. Convergent validity of the ICs measurement

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Items</th>
<th>Factor loadings</th>
<th>AVE</th>
<th>CR</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Sources</td>
<td>MS1</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MS2</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MS3</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authority</td>
<td>AU1</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AU2</td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AU3</td>
<td>0.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AU4</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>CO1</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO2</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO3</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO4</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO5</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>TE1</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TE2</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TE3</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TE4</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaboration</td>
<td>EL1</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EL2</td>
<td>0.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EL3</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EL4</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EL5</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Match</td>
<td>MA1</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MA2</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MA3</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Discriminant validity of the ICs measurement

<table>
<thead>
<tr>
<th>Constructs</th>
<th>MS</th>
<th>AU</th>
<th>CO</th>
<th>TE</th>
<th>EL</th>
<th>MA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple S.</td>
<td>0.748</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AU</td>
<td>0.307</td>
<td>0.770</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>0.213</td>
<td>0.216</td>
<td>0.793</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td>0.188</td>
<td>0.509</td>
<td>0.184</td>
<td>0.720</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elaboration</td>
<td>0.298</td>
<td>0.198</td>
<td>0.348</td>
<td>0.203</td>
<td>0.785</td>
<td></td>
</tr>
<tr>
<td>Match</td>
<td>0.113</td>
<td>0.440</td>
<td>0.271</td>
<td>0.391</td>
<td>0.420</td>
<td>0.817</td>
</tr>
</tbody>
</table>

3.2 Differences in information commitments

A paired t-test is used to compare two standards under the same construct of information commitment. As Table 3 shown, for the accuracy construct, the results exposed a significant mean difference for two measurement items at p < .01. Respondents preferred using “multiple sources” (M=5.012) to evaluate the accuracy of shopping information than using “authority” (M=4.800). Under the usefulness construct, it was observed that two standards were significantly different at p<.05. Respondents agreed that “content” (M=5.281) of website were more useful than “technical” (M=4.711). For the searching strategy construct, there was a significantly differences between two standards. Respondents tended to use “elaboration” strategy (M=5.265) more than “match” strategy (M=4.640) when they search consumption information.

Table 3. Paired t-tests for consumption information commitments

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Standards</th>
<th>Mean (S.D.)</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Multiple sources</td>
<td>5.012 (1.074)</td>
<td>7.107**</td>
</tr>
<tr>
<td></td>
<td>Authority</td>
<td>4.800 (1.118)</td>
<td></td>
</tr>
<tr>
<td>Usefulness</td>
<td>Content</td>
<td>5.281 (0.996)</td>
<td>2.447*</td>
</tr>
<tr>
<td></td>
<td>Technical</td>
<td>4.711 (1.250)</td>
<td></td>
</tr>
<tr>
<td>Searching strategy</td>
<td>Elaboration</td>
<td>5.265 (1.052)</td>
<td>7.976**</td>
</tr>
<tr>
<td></td>
<td>Match</td>
<td>4.640 (0.987)</td>
<td></td>
</tr>
</tbody>
</table>

Note: *p<.05; **p<.01

Gender difference in consumption information commitment was also examined in this study. In Table 4, the results indicated that there were gender differences only on “multiple sources” (t=2.181, p<.05) and “content” standard (t=2.744, p<.01). Female respondents (M=5.091) tended to use “multiple sources” to judge accuracy of shopping information than male respondents (M=4.746). In addition, females (M=5.373) agreed that “content” of website more useful than males (M=4.973).

Table 4. Gender differences in consumption information commitments

<table>
<thead>
<tr>
<th>Standards</th>
<th>Dimensions</th>
<th>Gender</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Multiple sources</td>
<td>Female (S.D.)</td>
<td>5.091 (1.028)</td>
</tr>
<tr>
<td></td>
<td>Authority</td>
<td>Male (S.D.)</td>
<td>4.746 (1.188)</td>
</tr>
<tr>
<td>Usefulness</td>
<td>Content</td>
<td>Female (S.D.)</td>
<td>5.373 (0.938)</td>
</tr>
<tr>
<td></td>
<td>Technical</td>
<td>Male (S.D.)</td>
<td>4.746 (1.122)</td>
</tr>
<tr>
<td>Searching strategy</td>
<td>Elaboration</td>
<td>Female (S.D.)</td>
<td>5.332 (0.997)</td>
</tr>
<tr>
<td></td>
<td>Match</td>
<td>Male (S.D.)</td>
<td>4.632 (0.964)</td>
</tr>
</tbody>
</table>

Note: *p<.05; **p<.01
4. Discussion and Conclusion

Information commitments are a set of evaluative standards which Web users utilize in order to assess the accuracy and usefulness of Web-based materials, and searching strategy to achieve their assessment task [5]. This study extends application and measurement of information commitments into online consumption context. The results showed that good convergent validity and good reliability for online consumption ICs measurement were established.

The findings also indicated, compare to “authority” standard, respondents tended to use comparing consumption information from different websites to evaluate the accuracy of the information. Respondents may perceive low credibility of consumption information from popular websites, office websites, even though that information provide by exporters because sponsor posts and network rumors about consumption information spread out the websites [16]. This would lead them to use multiple information sources, such as magazine, or friends, to evaluate the accuracy of online consumption information. In addition, gender difference was observed in using “multiple sources” standard. The results are consistent with the gender difference arguments from previous research regarding how females and males process information in different ways. For example, females added higher values to both online and offline information sources while choosing travel destinations [17, 18].

Based on the results of current study, future research can focus on exploration of the antecedents and consequences of information commitments in consumption domain. For example, shopping orientation refers to a consumer’s general attitudes about shopping [19]. Several researchers have documented that consumers’ shopping orientation has an impact on their patronage behaviour, including also their store choice [20, 21]. If consumers are economic shoppers, they may prefer to use the authority standard to evaluate accuracy of consumption information for saving their time. This line of research will be helpful for understanding consumers’ cognitive process in evaluating online consumption information, and for designing the website contents.

References


Author Guidelines

This document provides some guidelines to authors for submission in order to work towards a seamless submission process. While complete adherence to the following guidelines is not enforced, authors should note that following through with the guidelines will be helpful in expediting the copyediting and proofreading processes, and allow for improved readability during the review process.

I. Format

- Program: Microsoft Word (preferred)
- Font: Times New Roman
- Size: 12
- Style: Normal
- Paragraph: Justified
- Required Documents

II. Cover Letter

All articles should include a cover letter as a separate document.

The cover letter should include:

- Names and affiliation of author(s)

The corresponding author should be identified.

Eg. Department, University, Province/City/State, Postal Code, Country

- A brief description of the novelty and importance of the findings detailed in the paper

Declaration

v Conflict of Interest

Examples of conflicts of interest include (but are not limited to):

- Research grants
- Honoria
- Employment or consultation
- Project sponsors
- Author’s position on advisory boards or board of directors/management relationships
- Multiple affiliation
- Other financial relationships/support
- Informed Consent

This section confirms that written consent was obtained from all participants prior to the study.

- Ethical Approval

Eg. The paper received the ethical approval of XXX Ethics Committee.

- Trial Registration

Eg. Name of Trial Registry: Trial Registration Number
Contributorship

The role(s) that each author undertook should be reflected in this section. This section affirms that each credited author has had a significant contribution to the article.

1. Main Manuscript
2. Reference List
3. Supplementary Data/Information

Supplementary figures, small tables, text etc.

As supplementary data/information is not copyedited/proofread, kindly ensure that the section is free from errors, and is presented clearly.

III. Abstract

A general introduction to the research topic of the paper should be provided, along with a brief summary of its main results and implications. Kindly ensure the abstract is self-contained and remains readable to a wider audience. The abstract should also be kept to a maximum of 200 words.

Authors should also include 5-8 keywords after the abstract, separated by a semi-colon, avoiding the words already used in the title of the article.

Abstract and keywords should be reflected as font size 14.

IV. Title

The title should not exceed 50 words. Authors are encouraged to keep their titles succinct and relevant.

Titles should be reflected as font size 26, and in bold type.

IV. Section Headings

Section headings, sub-headings, and sub-subheadings should be differentiated by font size.

Section Headings: Font size 22, bold type
Sub-Headings: Font size 16, bold type
Sub-Subheadings: Font size 14, bold type

Main Manuscript Outline

V. Introduction

The introduction should highlight the significance of the research conducted, in particular, in relation to current state of research in the field. A clear research objective should be conveyed within a single sentence.

VI. Methodology/Methods

In this section, the methods used to obtain the results in the paper should be clearly elucidated. This allows readers to be able to replicate the study in the future. Authors should ensure that any references made to other research or experiments should be clearly cited.

VII. Results

In this section, the results of experiments conducted should be detailed. The results should not be discussed at length in
this section. Alternatively, Results and Discussion can also be combined to a single section.

Ⅷ. Discussion

In this section, the results of the experiments conducted can be discussed in detail. Authors should discuss the direct and indirect implications of their findings, and also discuss if the results obtain reflect the current state of research in the field. Applications for the research should be discussed in this section. Suggestions for future research can also be discussed in this section.

IX. Conclusion

This section offers closure for the paper. An effective conclusion will need to sum up the principal findings of the papers, and its implications for further research.

X. References

References should be included as a separate page from the main manuscript. For parts of the manuscript that have referenced a particular source, a superscript (ie. [x]) should be included next to the referenced text.

[x] refers to the allocated number of the source under the Reference List (eg. [1], [2], [3])

In the References section, the corresponding source should be referenced as:

[x] Author(s). Article Title [Publication Type]. Journal Name, Vol. No., Issue No.: Page numbers. (DOI number)

XI. Glossary of Publication Type

J = Journal/Magazine
M = Monograph/Book
C = (Article) Collection
D = Dissertation/Thesis
P = Patent
S = Standards
N = Newspapers
R = Reports

Kindly note that the order of appearance of the referenced source should follow its order of appearance in the main manuscript.

Graphs, Figures, Tables, and Equations

Graphs, figures and tables should be labelled closely below it and aligned to the center. Each data presentation type should be labelled as Graph, Figure, or Table, and its sequence should be in running order, separate from each other. Equations should be aligned to the left, and numbered with in running order with its number in parenthesis (aligned right).

XII. Others

Conflicts of interest, acknowledgements, and publication ethics should also be declared in the final version of the manuscript. Instructions have been provided as its counterpart under Cover Letter.
About the Publisher

Bilingual Publishing Co. (BPC) is an international publisher of online, open access and scholarly peer-reviewed journals covering a wide range of academic disciplines including science, technology, medicine, engineering, education and social science. Reflecting the latest research from a broad sweep of subjects, our content is accessible worldwide – both in print and online.

BPC aims to provide an analytics as well as platform for information exchange and discussion that help organizations and professionals in advancing society for the betterment of mankind. BPC hopes to be indexed by well-known databases in order to expand its reach to the science community, and eventually grow to be a reputable publisher recognized by scholars and researchers around the world.

BPC adopts the Open Journal Systems, see on http://ojs.s-p.sg

Database Inclusion

- National Library, Singapore
- Asia & Pacific area Science Citation Index
- China National Knowledge Infrastructure
- Creative Commons
- Google Scholar
- Crossref
- J-Gate
- My Science Work
Bilingual Publishing Co. is a company registered in Singapore in 1984, whose office is at 12 Eu Tong Sen Street, #08-169, Singapore 059819, enjoying a high reputation in Southeast Asian countries, even around the world.