Behavioral Accounting: Preliminary Findings from Eye-Tracking Facial Expression Analysis and Biosensors

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ABSTRACT

Behavioral accounting examines how individuals interpret accounting information and how cognitive and emotional factors affect decision-making. An experiment with 43 participants, including accounting experts and students, was conducted to examine differences in the evaluation of financial data. Eye-tracking, facial expression analysis, and biosensors were used to record visual attention and emotional responses during accounting tasks. Preliminary results show differences between experts and non-experts in response time, gaze patterns, and emotional reactions. Experts processed the information more efficiently and distributed their attention more evenly across visual elements, while students showed higher levels of confusion and limited attention to graphical representations.

KEYWORDS

Behavioral Accounting, Eye-tracking, Bio Sensors, Face Expression Recognition, Experimental Study

Introduction

Behavioral Accounting studies how individuals interpret accounting information and how cognitive and emotional factors influence their judgments and decisions [1]. Traditional accounting research has mainly focused on financial outcomes and numerical accuracy, while behavioral accounting shifts the attention to the way people process financial information and make decisions based on it.

Methods from neuroscience and human–computer interaction provide new tools for examining these processes. Physiological and behavioral measurements allow researchers to observe how individuals respond to complex information in real time. Technologies such as eye-tracking systems, facial expression analysis, and biosensors make it possible to capture attention patterns, emotional reactions, and physiological responses during decision-making tasks.

Eye-tracking records gaze paths, fixation duration, and visual attention, helping researchers understand how users explore visual stimuli and which elements attract their attention [2],[3],[4]. Emotional reactions can also be examined through affective computing techniques, which analyze facial expressions and other physiological signals to detect changes in emotional state [5], [6]. In addition, psychophysiological measurements collected through biosensors provide indicators related to cognitive load and emotional arousal during information processing [7].

The study presented in this paper examines how individuals interpret accounting data using multimodal behavioral measurements. The experiment focuses on differences between accounting experts and students, analyzing visual attention, emotional responses, and decision behavior during the evaluation of accounting information.

2 Experiment

The experiment was setup and conducted using the iMotions Lab (https://imotions.com) with Affectiva (https://www.affectiva.com) installed for facial expressions and emotions recognition. Both software connected to the Tobii Pro Nano eye-tracker (https://www.tobii.com). Additional sensors available in the Bitbrain Versatile Bio kit (https://www.bitbrain.com) were also used, along with Bitbrain SennsLite software for reading the recorded bio signals: EDA / GSR (measures the participant's skin conductance, which reflects sweating activity and indicates physiological arousal or stress levels), temperature (measures the skin temperature of the participant), ECG (records cardiac activity), EMG (measures muscle activity, which can indicate movement, tension, or anxiety-related physiological responses), IBI (shows the time interval between consecutive heartbeats), IMU (measures the movement and orientation of the amplifier) respiratory sensor (measures the participant's breathing rate). Data recorded by SennsLite were raw and thus Python scripts were written to calculate and visualize metrics, as well as synchronize it with the iMotions recordings and analysis.

The goal of the experiment was to examine how participants deal with the accounting data they see (depending on their background), to observe how their emotions change, to record visual behavior and attention for each question and to explore which is the preferred representation of data (tabular numerical form or chart) preferred

The experiment scenario included 8 questions about accounting content, and each participant was asked to answer these 8 questions. There was a total of 43 participants, 9 of whom belonged to the expert category (to be considered expert, one had to have a minimum of 3 years' professional experience in the accounting field). Before and after the experiment, the participant filled out a pre- and a post-questionnaire, which help in drawing specific conclusions and comparing user perceptions and recorded data. Participants were allowed to answer at their own pace, so as not to impose stress that would be recorded but would not be due to the data/stimulus observed.

Indicatively, Figure 1 depicts the recording of a non-expert participant while viewing a specific question accompanied by the accounting data. Fifteen seconds after the screen was displayed (see vertical line), the participant was still reading the question, and Affectiva recorded a peak in engagement, surprise, confusion, and attention. At the same time, ECG and IBI show a peak, while temperature, EDA, and EMG gradually decrease, whereas IMU and respiration pace remain relatively stable. These physiological responses may indicate increased cognitive processing and attentional engagement while the participant attempts to interpret the accounting information. The combination of facial expression analysis and biosensor signals suggests a moment of heightened cognitive load during the evaluation of the presented data.

3 Preliminary findings

After the data cleaning process, the synchronization of signals, the calculation of metrics, and the extraction of data from Affectiva, the following conclusions were drawn: (1) experts required much less time than students, (2) students demonstrated a significantly higher confusion compared to experts, who showed either low or no confusion at all, (3) most students barely focused on the charts accompanying specific questions, but experts focused on both the tables and the charts, (4) for all participants, decision-making was affected by their attitude towards the company (or the brand more generally), and (5) experts demonstrated repeated fixations in AOIs containing crucial data for decision-making, while students did not focus their visual attention accordingly.

4 Conclusion

The results indicate differences between experts and students in how accounting information is processed, reflected in the time required to complete tasks, visual attention patterns, and emotional reactions. These preliminary findings suggest that multimodal behavioral measurements can provide useful insights into accounting decision-making, while a more detailed analysis of the collected data is currently in progress.

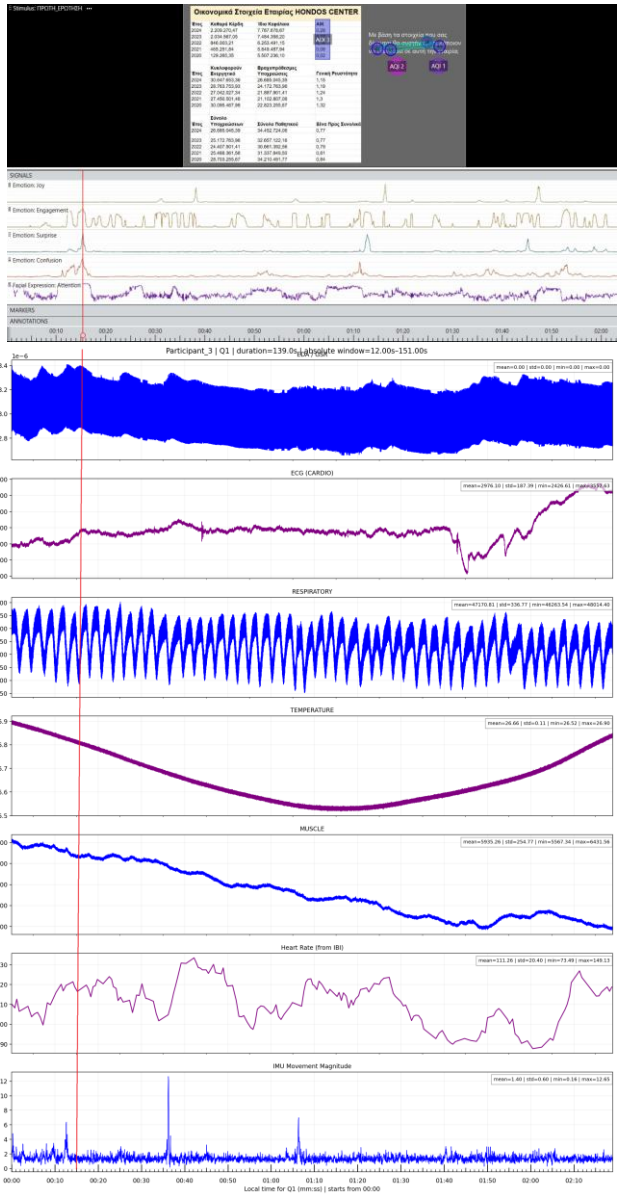

Figure 1: The topmost part shows the replay of a participant recording in iMotions Lab with Affectiva selected input (joy, engagement, surprise, confusion, attention). The lower part depicts the synchronised visualizations of the bio signals

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