FFM-MHI Vis: Visualizing How Personality and Sociodemographic Factors Have an Effect on Mental Health

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Abstract

In the last decade, mental health has been a current topic of research on the area of Psychology, since this kind of disorders make up 10% of the global number of disease. Moreover, individual differences, like personality traits, are psychological constructs that model mental health. In addition, social and demographic factors that influence both these constructs, such as age and gender, have not been explored in-depth regarding their relationship with mental health. Weighting how participatory design allows designers to understand current end-user practices and improve the quality of the end product, we developed an Information Visualization (InfoVis) tool alongside psychologists and researchers to study the relationship between sociodemographic, personality, and mental health factors. In particular, we used a user-centered design approach to develop our prototype, and usability and utility testing to validate it. Results show that our interactive system achieved high scores of Perceived Usability, Usefulness, and Ease of Use, along with participants completing a set of tasks with good performance. Our findings empower researchers with the ability of interrelating different variables related to Psychology using an InfoVis tool, instead of a more classical approach, such as the usage of specific statistical software.

Keywords: Information Visualization, Psychology, Personality, Five-Factor Model, Mental Health, Mental Health Index, Sociodemographic Factors

1. Introduction

Mental health is a very commonly researched topic nowadays. According to the World Health Organization (WHO), it can be defined as "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" [1]. External factors, like society [2], and individual differences, like personality traits [3], contribute to it. Regarding personality, it can be defined as the agglutination of habits, traits, attitudes and ideas that one has [4]. Additionally, this psychological construct is highly influenced by the social and demographic context, which tends to define the way one thinks and behaves [5]. However, there is a lack of research on the relationship between these three variables addressed. Additionally, typical scientific software can be very crumble some and impractical to analyse such a magnitude of relationships. In this sense, this work addresses the problem of **the effect of sociodemographic factors in personality traits and mental health**.

In the light of this, we leverage information visualization techniques and user-centered design methodologies in order to create with Psychological researchers an InfoVis tool, focused on allowing the user to comprehend large amounts of data immediately and perceive emergent properties that are not anticipated, while facilitating the understanding of both large-scale and small-scale data features. As such, our main contribution is to **study ways in which Information Visualization techniques allow researchers to verify whether sociodemographic features have an effect on personality and mental health**. Additionally, we conduct both utility and usability testing phases to validate our prototype.

The paper is structured as follows. Section 2 addresses a theoretical background regarding personality traits, mental health and sociodemographics. Section 3 hands out the data analysis executed before starting the prototype implementation. Section 4 presents a system overview, describing the complete design process. Next, Section 5 approaches the system evaluation and discuss its results. Section 6 finishes with the conclusions we can take from this work, as well as what to do in the future.

2. Related Work

In this section, we discuss models on personality psychology, address mental health, and approach the concept of sociodemographic factors. Some related works on these matters are also presented.

2.1. Personality

Personality and personality psychology are two subjects which have been studied continuously for many decades. Personality can be defined due to stable differences that exist in individuals [6]. Besides that, one cannot define personality without defining personality traits as well [7], and checking what can be drawn from them in order to analyze someone as a whole.

An example of an InfoVis regarding Personality is *PEARL*, developed by Zhao et al. for understanding personal emotion style derived from social media [8]. By using sentiment analysis classifiers and mood analysis for tweets, it is possible to determine one's basic emotions, anticipation and trust along time. A screenshot of *PEARL* can be seen in Figure 1. Several different areas can be determined: (1) the emotional profile overview, represented by a stacked area chart, being each color a different emotion (the legend can be found in (7)), (2) a detailed emotional profile overview, represented by an area chart (a copy of the highlighted time window in (5)), (3) a mood word view, measuring arousal and valence, represented by a scatterplot, (4) raw tweets view, with highlighted words used to compute each emotion, and (6) an action menu, that allows a user to highlight important points in the chart (each point description is shown in (8)).

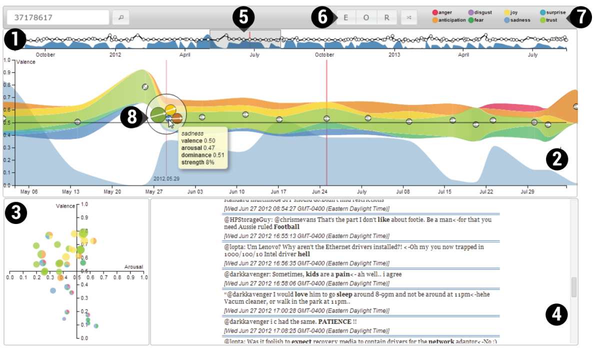


Figure 1: Screenshot of *PEARL* [8].

Over the years, a lot of theories about personality were clinically studied. In this study, though, we are going to analyze a different, more recent, theory: the Five-Factor Model (FFM). The FFM was designed by Goldberg, who first suggested the term "Big Five", i.e. the five most important personality traits existent in one's personality [9]. Such traits are **Neuroticism**, **Extraversion**, **Openness to Experience**, **Agreeableness** and **Conscientiousness**. These five traits are also commonly (and more generally) called FFM. Several different approaches have been used to measure these elements of personality; the more common ones are through the use of surveys or questionnaires [10]. One of these is the NEO-FFI, which consists in a set of 60 questions (12 per trait) used to evaluate this model. It is a reliable version, showing an internal consistency between 0.68 and 0.86 with the FFM domains [11].

Another example of a work related to the FFM is the one developed by Wang et al.: *VeilMe*, an interactive visualization tool for privacy configuration of a Twitter user by measuring three different types of personality traits: the Big Five, needs (evaluated as ideals, harmony, closeness, self-expression, excitement and curiosity) and values (evaluated as self-transcendence, conservation, self-enhancement, openness to change and hedonism) [12]. Each of these types is composed of five to six traits, which are computed with percentile scores against the population. Therefore, one can say there's an hierarchical structure amongst these types. A screenshot of the *VeilMe* interface can be seen in Figure 2. There are four different areas in this visualization: (1) user information, (2) latest tweets, (3) portrait exploration panel, and (4) privacy setting panel. By clicking in a trait, the panel is expanded, revealing all its facets and their measurement. By hovering on a social distance knob in area (4), usernames that match that knob will be shown, revealing connections and user engagement. Each trait is represented by an horizontal bar, and types of traits are differentiated with the usage of color.

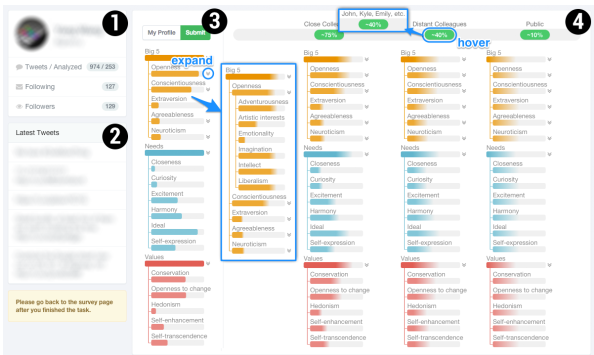


Figure 2: Screenshot of *VeilMe* [12].

2.2. Mental Health Index

In 1975, Veit and Ware, Jr. started working on the Mental Health Inventory, also named MHI-38. Its primary goal was to measure general psychological distress and well-being. It consists in a set of 38 questions, designed to evaluate five different factor groupings: anxiety, depression, behavioral/emotional control, general positive affect and emotional ties. The first three of these are related to psychological distress, whilst the last two are associated with psychological well-being [13]. This survey allows to measure the Mental Health Index (MHI) of oneself.

One of the subsequent questionnaires designed to evaluate this matter is the MHI-5 [14], consisting in a set of just five questions. Researchers concluded that the MHI-5 has a correlation between 0.93 and 0.95 with the original MHI-38 [15, 16].

Studies have proved that a profile that shows high neuroticism, low conscientiousness, low agreeableness and low extraversion is the most common pattern of personality traits associated with mental disorders. Neuroticism is also the most consistent and effective of the FFM traits to predict psychopathology [17]. Extraversion relates to high levels of emotional well-being, and neuroticism to lower levels [18].

One good instance of a study related to the subject of mental health is the one conducted by Zhou et al. Based on the University Personal Inventory (UPI), an inventory composed of 60 questions, widely used in China to assess the mental health status of college students [19], they developed *VisUPI*, a visualization tool for UPI datasets [20]. Figure 3 presents a screenshot of *VisUPI*, which is divided in seven different areas, such as: (1) personal information, (2) the user's response and evaluation to each of the UPI questions, (3) a multidimensional scaling chart, presenting the difference between questionnaires, (4) a sunburst chart, designed to layout the questionnaires and visualize each individual's answers, (5) a radial Voronoi diagram, indicating the correlation between UPI answers, and (6) a hierarchical structure (7) and a bar chart, indicating the detailed answer distributions of questionnaires.

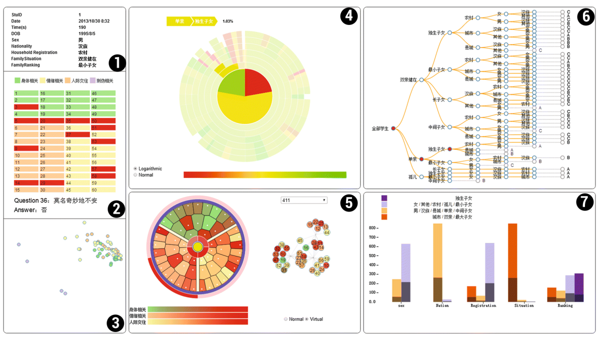


Figure 3: Screenshot of *VisUPI* [20].

2.3. Sociodemographic Factors

According to Merriam-Webster's Dictionary, *sociodemographics* can be defined as "a combination of social and demographic factors"[1]. Social factors have an effect in the lifestyle of oneself. Some of these are wealth, household, education, social mobility, employment status, income inequality and community safety [21]. On the other hand, demographic factors are more related with demography, i.e. "the statistic study of human populations"[2]. Between these, we find age, gender, and marital status.

Sociodemographic factors are directly connected to personality and mental health. For example, adolescents undergo important changes in their self-esteem, severly influenced by their socioeconomic position, alongside personality traits and sociocultural determinants [22]. Moreover, adolescents of low socioeconomic status seem to be more vulnerable in comparison with others from a higher socioeconomic status. Personality and a lack of mental health were proven to contribute to this relationship [23]. A different study determined that people with lower levels of psychological distress (one of the mental health strands) tend to be more satisfied with their lives. This study also found a correlation between sociodemographic factors and well-being: women tend to be happier than men; at the same time, those who have purchased their own homes or have a tertiary education are also more satisfied about their lives. On the contrary, subjects unemployed or divorced tend to see life in a more negative light [24].

2.4. Discussion

Since one of the objectives of this work is the development of an InfoVis system, some remarks from the state-of-the-art can be extrapolated to our own study. First, the Focus-plus-Context rule, where viewers are able to check the object of interest in detail while getting an overall impression of all the surrounding information [25], is present in every single of these visualizations. Semantically speaking, there are also some conclusions that can be taken from these works. Amongst the channels used for data encoding, the most common ones found are position, color (usually, hue), area and size. Thus, it is possible to trace a parallel with this particular work, which, in the same way, will tend to use the same visual encodings previously enumerated.

3. Data Analysis

This section depicts the tasks executed before the implementation of an Information Visualization technique *per se*, as well as the participants and used apparatus.

3.1. Participants

It was not necessary to generate a database with the participants' answers. Instead, this database already existed, and was provided for the devel-

[1] https://www.merriam-webster.com/dictionary/sociodemographic.

[2] https://www.merriam-webster.com/dictionary/demography.

opment of this specific study. It contains all the relevant information to create an InfoVis tool that relates the FFM, the MHI and sociodemographic factors. The database subjects were recruited and their answers were collected by a group of researchers from the Faculdade de Psicologia da Universidade de Lisboa (FPUL). Altogether, a total of 200 participants, with their data and answers treated anonymously, indirectly made a contribution for this work. 35% of the subjects (70 in total) are male, whilst the other 65% (130 in total) are female. Their ages range between 18 and 76 years old. All of them are Portuguese.

3.2. Apparatus

In order to feed its database entry, each subject of this study answered some questions regarding sociodemographic factors (namely, age, gender, nationality, residence, schooling level, profession, current economic situation, marital status, household and religion). For the collection of personality data, the NEO-FFI questionnaire was used. Finally, for the measurement of mental health, the MHI-5 inventory was also utilized.

3.3. Data Pre-Processing

The results of the NEO-FFI and MHI-5 questionnaires used for this work were also studied and plotted. Table 1 presents the value comparison of mean (μ) and standard deviation (σ) for each of the FFM traits, as well as for the MHI, between the participants of this study and the Portuguese population [11, 16].

By analyzing the results obtained in Table 1, it is important to emphasize that the values that will be used for this study are very close to the ones obtained amongst the Portuguese population, and therefore do not diverge that much. One could argue, though, that the one value that shows a higher discrepancy is the MHI, where the values of mean, μ, and standard deviation, σ, are roughly six percent apart between the two studies. Nevertheless, this difference is not problematic, because the distance between the two is not that high (the coefficient of variation, i.e. $c_v = \sigma/\mu \leq 1$ for all values studied, thus indicating a low variation) [26].

4. User-Centered Design

The design methodology starts with the preliminary tasks that were necessary to accomplish in order to pre-process the provided data, and fit it into the InfoVis tool developed. As mentioned, our work adopts a user-centered design approach; this means that the target audience (psychologists and researchers linked to Psychology) had a word to say in every development stage [27]. The four implementation stages of this work are introduced by chronological order, as shown in Figure 4.

Table 1: Value comparison between this study and the Portuguese people [11, 16].

	This study		Portugal	
	μ	σ	μ	σ
Neuroticism (N)	22.82	7.41	23.92	7.46
Extraversion (E)	30.18	6.53	29.55	6.01
Openness (O)	27.84	5.59	27.54	6.30
Agreeableness (A)	32.29	5.39	32.49	5.61
Conscentiousness (C)	35.36	6.30	34.26	6.31
MHI (%)	65.62	14.16	59.74	19.94

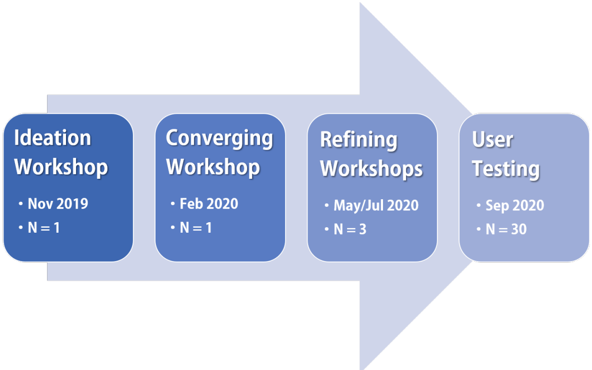


Figure 4: Different stages executed during the processing of this work, as well as their dates and number of participants.

4.1. Ideation Workshop

The first step in the development of the user-centered design process is the execution of a requirements elicitation about the system to be developed with the experts in this field of study, and understanding which features must be present in order to fulfill the necessary tasks.

On November 2019, a meeting, in the form of an interview, was realized with the main Psychology researcher conducting this study, in order to execute the requirements elicitation mentioned above. These requirements could be seized using a set of ten questions previously thought to address this theme. By analysing the answers obtained, the system can now be better perceived. It must be a dashboard; it must examine the FFM, the MHI and sociodemographics altogether, and this task will imply several idioms for that to work; it must focus on the traits' global score, but also in each individual answer to the questionnaires; it must set a color scheme so that a user can perceive immediately the ordinal classification of an answer; it should be designed for scalability; it must have a scatterplot as one of the idioms; and it definitely must able a user to compare several subjects or filter data over a desired group.

4.1.1. Reflections

The solution architecture schema for this work can be analysed in Figure 5. A user is able to interact with the interface via inputs given by an optical mouse, which allows to modify the visualization to show it to the user accordingly. However, for this to happen, a different computer has to process the collected data, creating a database that will feed the interface with the desired values that can be shown to the user. This architecture allows the user to perform several tasks and answer their questions, as we further discuss in the next Section.

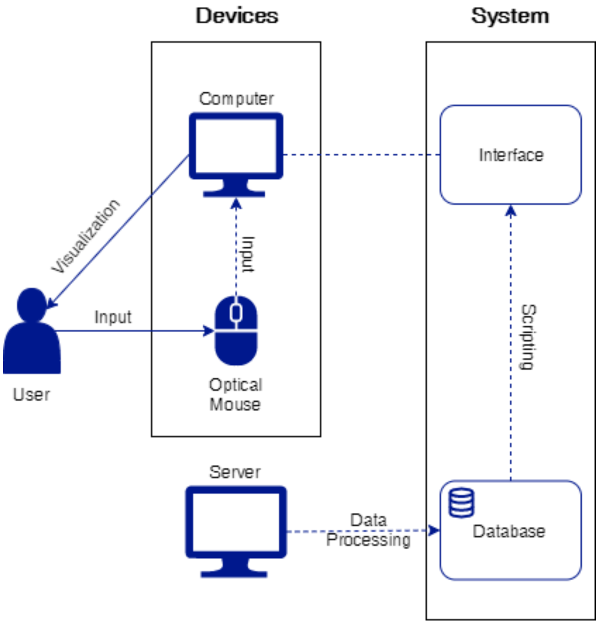


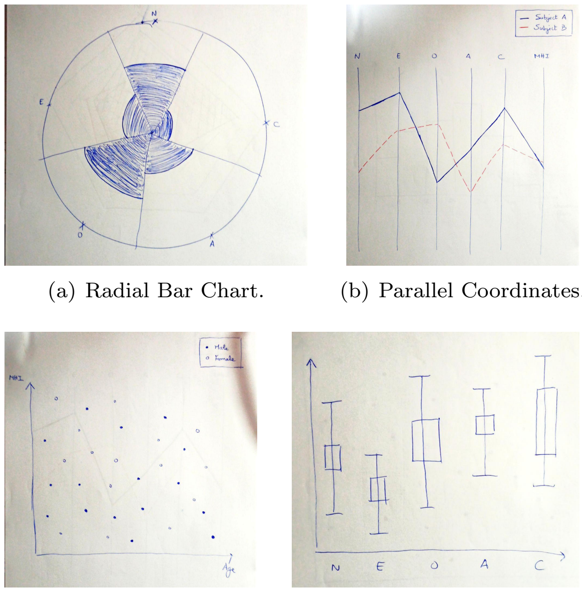
Figure 5: Solution architecture.

This information visualization tool is a Single-Page Application (SPA): a website that does its user interaction by dynamically rewriting the current page, instead of loading new ones [28]. As so, the client-side of this system uses HTML5 (i.e. HTML, CSS and JavaScript) to render the page and its elements. The system also uses Vue.js[3], a JavaScript framework focused on the view layer of an application, alongside Quasar[4], which provides a user interface based on Material Design[5], used in the majority of Android applications.

As for the development and implementation of the interactive idioms and charts, *d3.js*[6], a JavaScript library designed for interactive visualizations, was employed in the visualization implementation. Regarding this system's server-side, it is used a simple server written in Node.JS[7].

4.2. Converging Workshop

On February 2020, a Converging Workshop was conducted, in the form of an interview, with the same researcher. The main goal of this meeting was to understand what were the preferences of the target users in the implementation of this visualization; in this case, what should be the chosen idioms. Drafts of the possible idioms were drawn using a simple pen and paper style, prior to this workshop. Examples of such idioms are depicted in Figure 6.



(a) Radial Bar Chart. (b) Parallel Coordinates. (c) Scatterplot. (d) Boxplots.

Figure 6: Examples of drafts of different charts, designed for the Converging Workshop.

4.2.1. Reflections

The following idioms were chosen to be implemented in the prototype: a parallel coordinates chart, a scatterplot, a boxplot, a histogram, and a colored heatmap. Therefore, the system started to be implemented at this point, taking into account the feedback provided. In the middle of this work, new meetings with experts in this subject were required, in order to collect feedback and measure the utility of this system. These meetings were named Refining Workshops.

4.3. Refining Workshops

Two Refining Workshops were conducted with three psychologists; the first in May, the second in July 2020. Both utility and usability tests were realized. Using both tests not only provides feedback about the system and what improvements shall be made, but also indicates the developer, even if indirectly, which interface features are easy to understand and which may not be.

4.3.1. Reflections

Usability testing was evaluated first. In each session, users were allowed to explore the prototype by themselves, until they thought they knew how to work with it. After that, they were asked to

[3] https://vuejs.org.
[4] https://quasar.dev.
[5] https://material.io/design.
[6] https://d3js.org.
[7] https://nodejs.org/en/.

perform a set of tasks over the system. The three users were able to successfully complete all tasks proposed, with little to no help from the developer. After accomplishing all tasks, they were informally asked to verbally evaluate the system, enumerating its pros and cons, and making some suggestions, if applicable. This procedure corresponds to utility testing. The verbal feedback obtained from these researchers ends up matching the utility testing desired, and was very helpful for the development of the final version of the prototype.

4.4. System Overview

This system was suggestively named *FFM-MHI Vis*, since its main objective is trying to correlate the FFM traits with the MHI of oneself, taking into account sociodemographic factors. A screenshot of the interface is depicted in Figure 7. There are five main idioms presented in this visualization: a **Parallel Coordinates** chart (top left corner), a **Scatterplot** (top right corner), a **Boxplot** (bottom left corner), a **Sankey** diagram (bottom right corner) and a **Heatmap** (right drawer; this chart is only presented when one or more users are highlighted).

The parallel coordinates chart is used to identify the five personality traits and MHI of oneself. The scatterplot depicts the sample's age variation in function of a given trait. The boxplots show the distribution of the sample for each provided trait. The Sankey diagram presents the relationship between different sociodemographic factors. The heatmap portrays the individual answers of a particular subject in the NEO-FFI and MHI-5 questionnaires. Furthermore, the menus also contribute to the interactivity between idioms. The left drawer allows the user to choose a particular database subject, and, when selected, its scores are highlighted in each chart. On the top, blue drawer, four more menus can be found. The first one is the **Sociodemographics** menu, where these factors can be selected or deselected, and its order can be altered. Next to it, the **Filters** menu let the user to filter a particular subject by its ID, or a group of subjects based on sociodemographic factors, FFM traits, and/or the MHI. This subject selection is then highlighted in each chart. The **Settings** menu allows the user to make some customizations on the system, namely, the color encoding. Finally, the **Help** menu presents a guide to better interpret the interface and the idioms presented.

5. Evaluation

This section approaches the work realized after the conclusion of the final prototype, corresponding to usability and utility user tests. These tests allowed to perform the system evaluation under several metrics.

5.1. Apparatus

Due to the COVID-19 pandemic, user tests could not be conducted in person, and were instead realized using a videoconference software, which also allowed to share and record the screen. In order to measure the system's usability metrics, three surveys were used: System Usability Scale (SUS) [29], Technology Acceptance Model 3 (TAM-3) [30], and Task Load Index (NASA-TLX) [31]. SUS measures a system's Perceived Usability. TAM-3 computes a system's Perceived Usefulness and Ease of Use. NASA-TLX assesses six metrics regarding demands, performance, effort and frustration on interface usage (the lower these scores are, the better).

5.2. Participants

A total of 30 participants volunteered as users for this study, which do not have any type of constraints regarding their field of study. From these 30 users, 3 of them are psychologists or researchers on the theme of Psychology, and also realized utility testing. 70% are men, and only 30% are women. Their ages balance between 21 and 60 years old ($\mu \approx 27.63$, $\sigma \approx 11.09$). The vast majority of them have at least a bachelor's degree. Computer Science is the dominant work field between the participants, corresponding to approximately 77% of the sample. Psychology ends up representing only 10% of this population.

5.3. Procedure

Each session consists of three parts. The first one is the filling of a form that works as a small data gathering for the participant. The second one corresponds to the execution of six tasks, in an arbitrary order, over the developed system. These tasks encompass the entire implementation of the prototype. Finally, the user is asked to fill another form, in which the metrics previously addressed in Section 5.1 are collected.

5.4. Results

This section presents the hypotheses generated for this evaluation, as well as the results taken in both types of tests that were conducted: usability testing and utility testing.

5.4.1. Utility Testing

Utility tests were conducted with the three psychologists who volunteered for this study. Their feedback is crucial, not only because it validates the design process used for the purposes of this work, but also because this interface was designed for psychologists and researchers on Psychology.

One user, despite finding the system confusing at times, expressed its statisfaction with the interface's global coherence and general aspect. Other user stated that the system was fun to work with, and it was easy to access statistical data; nevertheless,

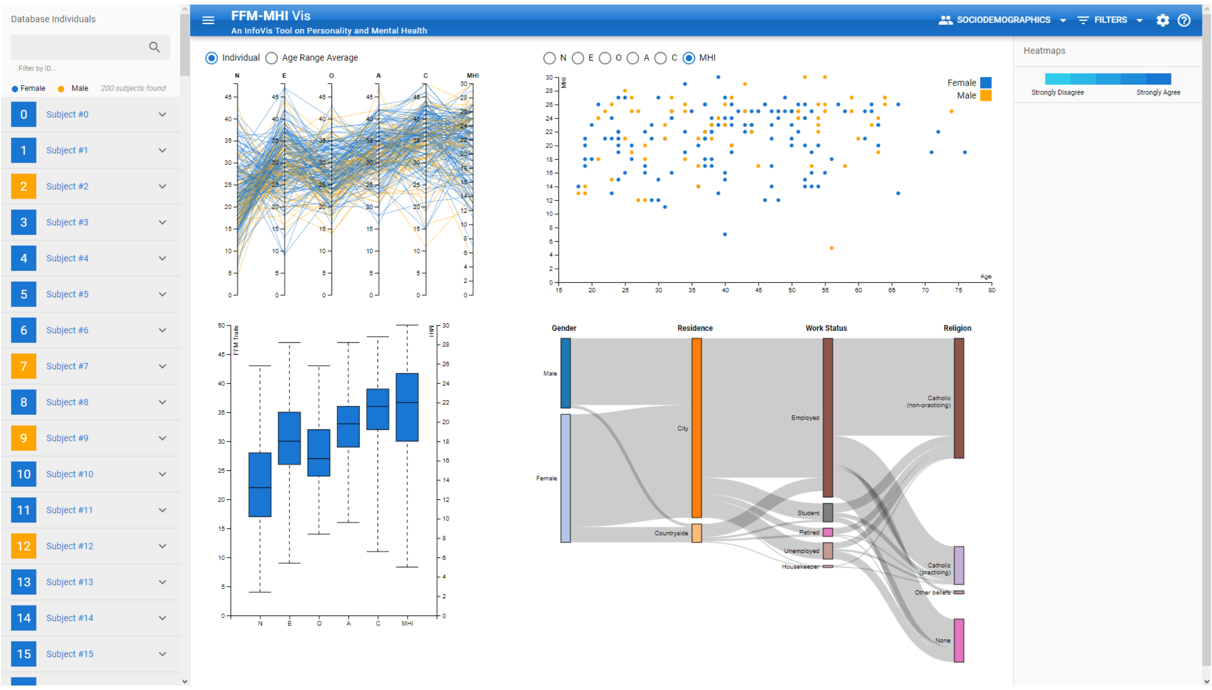


Figure 7: Screenshot of *FFM-MHI Vis*.

a first time user may feel certain difficulties in how to conveniently interact with the interface, as well as what the meaning of more uncommon idioms is. It also said the tool was clean and suggestive. The third psychologist stressed that the system was very intuitive, even stating that it is much easier to work with data via charts and direct manipulation than with statistical software such as SPSS.

5.4.2. Usability Testing

Two different data types were collected during this evaluation: the different metrics given by the SUS, TAM-3, and NASA-TLX questionnaires, but also the average task duration. In order to assess the metrics that evaluate the system, five hypotheses were created:

H1. The average SUS score must be above 72.5 points.

H2. The average score of both Perceived Usefulness and Perceived Ease of Use must be above 80% each.

H3. The average score of Mental Demand, Temporal Demand and Effort must be below 10 points.

H4. The average score of Performance and Frustration must be below 5 points.

H5. The average score of Physical Demand must be below 2 points.

Table 2 presents the mean (μ), standard deviation (σ) and Confidence Interval (CI) for each of these metrics. The ones that had its correspondent hypotheses accepted have their CI in bold, followed by an asterisk. Figures 8 and 9 depict the boxplots for each metric that was gathered. The results or this evaluation turned out to be very positive. The main achievements include a SUS score of approximately 85 ± 2, Perceived Usefulness and Ease of Use around 90 ± 1.65%, and a Performance metric of 2.77 ± 0.29 out of 20 points.

Table 2: Statistical results taken from SUS, TAM-3 and NASA-TLX questionnaires (CIs with an asterisk indicate accepted hypotheses).

Questionnaire	Metric	μ	σ	CI
SUS	SUS Score	84.92	1.94	**[80.95, 88.89]***
TAM-3	Perceived Usefulness (%)	91.42	1.65	**[88.06, 94.80]***
	Perceived Ease of Use (%)	87.14	1.67	**[83.74, 90.55]***
NASA-TLX	Mental Demand	6.23	0.77	**[4.66, 7.80]***
	Physical Demand	1.27	0.15	**[0.96, 1.58]***
	Temporal Demand	4.30	0.70	**[2.88, 5.72]***
	Performance	2.77	0.29	**[2.18, 3.35]***
	Effort	6.30	0.84	**[4.59, 8.01]***
	Frustration	2.87	0.58	**[1.67, 4.06]***

Regarding the measurement of the average task times, other two hypotheses were formulated:

H6. Being the most hardworking and demanding tasks to execute, it is expectable the average time for T1, T2 and T3 to be between 3:00 and 4:00 minutes each.

H7. Being the less meticulous tasks to execute, the expected average times for each of T4, T5 and T6 range between 1:00 and 1:30 minutes.

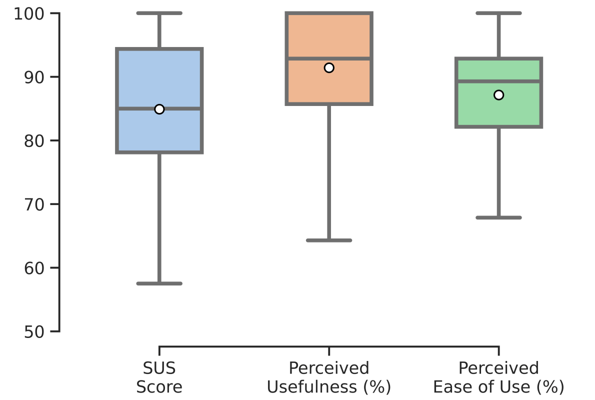


Figure 8: Boxplots for the metrics acquired from SUS and TAM-3 questionnaires. The white dot represents μ.

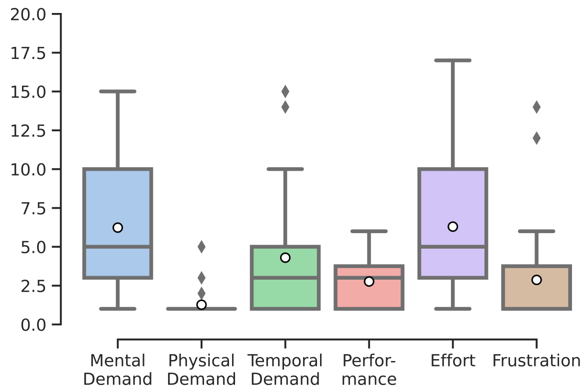


Figure 9: Boxplots containing the results taken from the NASA-TLX questionnaire. The white dot represents μ.

Table 3 presents μ, σ and CIs for each task performed. Again, CIs in bold followed by an asterisk are mapped with an hypotheses that was accepted. Moreover, Figure 10 depicts the distribution of times, in the form of a boxplot, for each requested task. The results or this evaluation turned out to be very positive. The average times thought were, in general, similar to the ones measured in this evaluation. Thus, the results went towards the original expectations.

Table 3: Statistical results taken from task times (CIs with an asterisk indicate accepted hypotheses).

Task	μ	σ	CI
T1	3:08	0:11	[**2:44, 3:32**]*
T2	2:51	0:11	[**2:27, 3:16**]*
T3	3:04	0:11	[**2:41, 3:27**]*
T4	1:15	0:08	[0:59, 1:32]
T5	0:41	0:02	[**0:35, 0:47**]*
T6	1:18	0:07	[1:04, 1:33]

5.5. Discussion

The design methodology adopted has more influence in utility testing results, since in this type

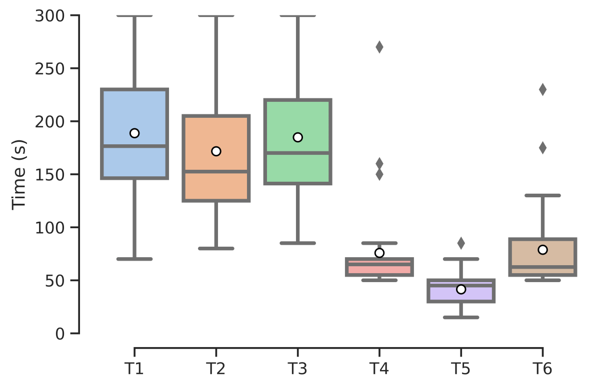


Figure 10: Boxplots containing the times (in seconds) measured in each of the tasks. The white dot represents μ.

of test, it is conducted a qualitative overview towards the system. Psychologists and researchers were asked for feedback on the prototype, and their opinions of it were positive. This had to do with the participatory design techniques employed in this study, where this tool was not only designed for them, but also *with* them [32]. Each realized workshop led in this direction, granting them a better system, which, in the end, has their own suggestions implemented. It is important to stress the feedback given by psychologists in these sessions. The most important one, which is also the most rewarding, was that working with this system is better and much easier than working with statistical software, such as SPSS. The prototype was also catalogued as aesthetic, clean, functional, coherent, intuitive and suggestive, thus allowing to conclude that this prototype was well designed and developed.

This user-centered design approach also demonstrates its impact when looking at usability testing outcomes. The high SUS score obtained (84.92 $\pm$ 1.94) proves the great usability of this system, which could not be obtained without the experts' help. We reckon the same when looking at the high percentages obtained in both Perceived Usefulness (91.42 $\pm$ 1.65%) and Perceived Ease of Use (87.14 $\pm$ 1.67%). The good degree of the Performance metric obtained in the NASA-TLX survey (2.77 $\pm$ 0.29 out of 20 points) denotes that their feedback and suggestions made the system better, more effective, and easier to use. At the same time, the low average times obtained in each of the six proposed tasks contribute to this perspective. Thus, we can conclude that the system met the expectations initially idealized and can be of great help for researchers.

5.5.1. Research Implications

This dissertation helps bridging the gap between personality traits, mental health and sociodemographic factors. In particular, the InfoVis tool developed adds up content to the state-of-the-art visualizations on Psychology, proving that it is possible to successfully correlate variables using an interactive visualization. Therefore, new works under this theme can seek the discovery of interconnections between topics using a tool like the one developed.

It is also significant to stress the importance of the user-centered design methodology employed in this study. Without the participation, decisions, feedback, and help provided by the experts in this field of study throughout the development of this work, we could expect lower results in both usability and, most significantly, utility tests. After all, this system is designed for their future use, and it is fundamental to understand their preferences and listen to their advices regarding the topic, leading to a more intuitive interface.

6. Conclusions

This dissertation approaches the problem of how do sociodemographic factors influence the mental health and personality traits. Despite previous studies have related the topics of personality and mental health, sociodemographics have not been included in this research. Therefore, the main goal of this study is to verify whether the usage of an Information Visualization technique is relevant for the purposes of the study between these three motives.

This work had three major contributions: a user-centered design methodology with researchers who are experts in this field of study; an Information Visualization prototype, which allows a user to correlate sociodemographic factors, personality traits, and mental health of subjects in a given database; and a set of both usability and utility tests that enabled the evaluation of the developed system.

Our findings assist the interrelationship between the three matters related to Psychology approached in this study. The outcomes obtained in the evaluation of the developed tool in this study attest that it is possible to do such using an interactive visualization. In this sense, new works on Psychology can successfully perceive the links between different matters using an InfoVis tool as well.

6.1. Future Work

It will be necessary to realize more user tests with the target audience: psychologists and researchers in that area. Additionally, a larger sample could show stronger results. It will also be important to provide the user more flexibility and customization. Not only can more settings be changed accordingly, but also change the interface display: the idioms can switch positions in the screen, and the same thing can happen with the menus. Another important feature to implement will be the ability to fully reconfigure a given idiom: it will be possible to present the same data, yet changing the chart as the user pleases. It will also be interesting to develop a plugin in which new personality features can be added to a database subject (e.g. Locus of Control) and compared with the original ones, thus providing a more in-depth model of each individual.

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