UNIVERSIDAD DE COSTA RICA
SISTEMA DE ESTUDIOS DE POSGRADO

# EVALUACIÓN DE LA USABILIDAD Y EXPERIENCIA DE USUARIO DE UN SISTEMA MULTIPLATAFORMA PARA LA ORIENTACIÓN VOCACIONAL

Trabajo final de investigación aplicada sometido a la consideración de la Comisión del Programa de Estudios de Posgrado en Computación e Informática para optar al grado y título de Maestría Profesional en Computación e Informática.

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Dedicatoria

A Dios, quien me dio la vida, y que merece el fruto de cada semilla que siembro en ella.

A Katherine, la mujer que me extendió su mano para caminar juntos en los retos de la vida.

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Tabla de Contenidos

# Resumen

La decisión de cual carrera profesional elegir sigue siendo difícil, incluso con la disponibilidad de varias pruebas vocacionales para proporcionar claridad en esta elección. La mayoría de las pruebas disponibles son monótonas, lo que resulta en un esfuerzo tedioso o aburrido. En este Trabajo Final de Investigación Aplicada, sin embargo, presentamos un enfoque nuevo y diferente para diseñar sistemas de orientación profesional. Utilizamos Google Home como una interfaz basada en voz y Telegram como una interfaz basada en texto para generar una conversación entre los usuarios y un bot para la orientación profesional. La idea es proporcionar una interfaz fácil y amigable con una experiencia de usuario interactiva mientras se recopilan los datos necesarios para proporcionar una guía de orientación profesional. Para evaluar la posible acogida del sistema, utilizamos el escenario de la Escuela de Ciencias de la Computación e Informática de la Universidad de Costa Rica. En este escenario, los estudiantes deben decidir entre tres posibles énfasis: Ingeniería de Software, Tecnologías de la Información y Ciencias de la Computación. Se realizó una evaluación de usabilidad y experiencia del usuario del sistema con la participación de 72 estudiantes de primer año.

# Capítulo 1

## Introducción

El presente documento detalla un trabajo realizado en el marco del Programa de Posgrado en Computación e Informática de la Universidad de Costa Rica. El trabajo realizado fue sometido a evaluación de pares internacionales en la 11 Conferencia Internacional en Computación Ubícua e Inteligencia Ambiental (UCAmI 2017).

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El artículo publicado se puede encontrar en su versión original en el Anexo 1 de este documento.

## 1.1 Problema

Los estudiantes de la Escuela de Ciencias de la Computación e Informática (ECCI) de la Universidad de Costa Rica (UCR) que ingresen a la carrera tendrán que elegir uno de los énfasis que entraron en vigor a partir del I semestre del 2017. Esta decisión, aunque simple, es de mucha importancia, ya que significa el camino profesional que seguirá el estudiante en su futuro. En el caso en el que un estudiante haya iniciado a cursar un énfasis y se percate que no se adapta a su perfil, se verán afectados, además del estudiante, la institución y la sociedad en general.

Como parte del desarrollo de este nuevo programa, se han hecho esfuerzos por abordar los énfasis ofrecidos por la ECCI desde el punto de vista académico, social y personal. Sin

embargo, debido a lo reciente de este cambio, no existe una herramienta desarrollada específicamente para estos estudiantes que provea de orientación profesional sobre la elección de un énfasis y, tampoco existen algún programa u órgano dentro e la universidad enfocado específicamente en este escenario.

Ciertamente existen muchas herramientas como [1], [2], [3] y [4] para ayudar a los estudiantes a descubrir sus habilidades, sus debilidades, personalidad y otros factores que puedan influenciar para tomar una decisión vocacional de esta naturaleza. Inclusive hay herramientas como [5], [6], [7] y [8] cuya respuesta final es, según así lo manifiestan sus autores, la decisión que un estudiante debería de tomar.

A pesar de la evidencia encontrada en sistemas de orientación vocacional, no se halló evidencia alguna sobre herramientas que les permitan a estudiantes en una situación similar a la descrita anteriormente informarse de una mejor manera para la decisión específica de seleccionar un enfoque profesional. Lamentablemente, dentro de los estudios realizados, tampoco se ha encontrado evidencia de evaluaciones sobre este tipo de herramientas que permitan conocer la usabilidad de estas con el objetivo de determinar si la interfaz propuesta genera una buena experiencia de usuario.

En el área de la computación, la experiencia de usuario consiste en tecnología que cumple más que solo las necesidades del usuario. Al hablar de experiencia de usuario se debe ser consciente de que el uso de una tecnología es subjetivo (depende del usuario), situado (depende del contexto), complejo y dinámico. La experiencia de usuario es se genera a partir de las características del sistema diseñado, el contexto y el estado interno del usuario [9]. Por otro lado la usabilidad se refiere a un conjunto de varios conceptos tales como, tiempo de ejecución, desempeño, satisfacción del usuario, facilidad de aprendizaje, aunque la lista puede ser diferente dependiendo del punto de vista del investigador [10].

Esto último es importante ya que con el fin de dar los pasos correctos en el proceso de desarrollo de un nuevo sistema de uso masivo que pudiese funcionar como una herramienta de orientación profesional para estudiantes de computación, se ha pensado crear un prototipo de sistema inteligente cuyo diseño este centrado en el usuario. Para ello se propone el uso de interfaces de voz y mensajería de texto.

Sin embargo, debido a que no fue posible hallar antecedentes para este tipo de sistemas, nace la pregunta: ¿Puede un sistema inteligente de orientación vocacional con interfaces de voz y mensajería texto proveer de una grata experiencia de usuario a los estudiantes de computación que busca definir un enfoque profesional?

## 1.2 Justificación

La evaluación de usabilidad propuesta se llevó a cabo en una prueba de concepto de un sistema de orientación vocacional inteligente que se desarrollará para este propósito. Dicho sistema basa sus decisiones en un análisis de personalidad obtenido a partir del motor de inteligencia artificial Watson [11].

Sobre este sistema correrán dos tipos de interfaces, una de voz y otra de mensajería de texto. Al evaluar estas interfaces será posible determinar si la prueba de concepto desarrollada es usable y, además, si genera una buena experiencia de usuario. Con esta evaluación de usabilidad, se espera que se desprendan conclusiones que al divulgarse permiten a terceros mejorar sus sistemas de orientación vocacional para lograr una mayor usabilidad en sus sistemas. Si esto se logra tendremos cada vez más, personas dispuestas a acudir al uso de sistemas de orientación vocacional.

Debido a que los estudiantes de la Escuela de Computación e Informática de la UCR, son los de mayor facilidad en cuanto acceso para el investigador, se espera conocer cuál es la opinión de los mismos respecto a la usabilidad del sistema, para, primeramente, mejorar

aquellos elementos que no hayan sido calificados como usables, y posteriormente incluir en un futuro sistema de orientación vocacional todos los aspectos de usabilidad que fueron evaluados positivamente.

Cabe destacar que la evaluación del resultado para los estudiantes dado por el sistema no es objeto de estudio de la presente propuesta, esto ya que el abordaje de este problema requiere de expertos en múltiples áreas. Por ejemplo, se debe recurrir en primera instancia a la comisión de la ECCI encargada de la elaboración de los planes de estudio y definición de los distintos énfasis que la escuela ofrece. Además, es necesario recurrir a profesionales en Psicología y Orientación Vocacional que con criterio experto puedan indicar cuales son los rasgos de personalidad que identifican en profesionales que se desempeñan los diferentes énfasis establecidos por la ECCI. Estos dos casos son solo un ejemplo de lo variado y complejo que es el proceso de orientación vocacional y por lo cual el resultado del sistema propuesto no es objeto de estudio de esta investigación.

## 1.3 Objetivos

### General

Evaluar a través de una prueba de usabilidad un sistema inteligente de orientación vocacional con interfaz de voz y mensajería de texto para determinar si es usable y genera una buena experiencia de usuario desde el punto de vista de los estudiantes de la Escuela de Ciencias de la Computación de la Universidad de Costa Rica.

### Específicos

1. Generar perfiles de personalidad ficticios de profesionales que se desempeñan en cada uno de los énfasis ofrecidos a partir del I semestre del 2017 por la Universidad de Costa Rica.

2. Integrar el motor de inteligencia artificial de IBM Watson con el dispositivo Home de Google y las plataformas de mensajería de Telegram y Facebook Messenger, con el fin de crear una prueba de concepto de un sistema inteligente para la orientación vocacional, capaz de reconocer perfiles de personalidad a partir de la interacción del usuario con interfaces no tradicionales.

3. Evaluar la integración de los sistemas anteriormente descritos con el fin de determinar la usabilidad de estos según el criterio de los usuarios finales.

El artículo adjunto en el Anexo 1 que fue presentado UCAmI 2017 nos permite responder la pregunta planteada en la sección 1.1 del presente documento. Esta pregunta no tenía respuesta si nos basamos en los esfuerzos realizados anteriormente por ofrecer una interfaz no tradicional en los procesos de orientación vocacional. Gracias a la metodología aplicada en la publicación realizada es posible obtener las conclusiones y resultados presentados a continuación en la sección de conclusiones.

# Capítulo 2

## Conclusiones

La ECCI ofrece tres programas de carrera para bachillerato con distinto énfasis: Ciencias de la Computación, Tecnologías de la Información e Ingeniería de Software. En este trabajo se desarrolló un asesor de carrera utilizando inteligencia artificial basada en Watson. Además, para este asesor, se desarrolló y se evaluó una interfaz controlada por voz (Google Home) y una basada en texto (Telegram y Facebook Messenger). Dicha evaluación se enfocó en la experiencia de usuario.

Con el objetivo de poder construir la herramienta que permitiera realizar dicha evaluación, fue necesario la obtención de perfiles auto identificados como profesionales de cada una de las ramas ofrecidas por el nuevo programa de la ECCI. Dichos perfiles, que, aunque no se pueden considerar representativos de la población de la ECCI, permitieron dar paso a construir el sistema de inteligencia artificial de orientación vocacional. Para este sistema, se recolectaron 10 textos originales de cada individuo perteneciente a cada una de las ramas, estos fueron extraídos de blogs personales de individuos auto identificados las distintas ramas.

Gracias a la tecnología que ofrece IBM Watson para el análisis de personalidad, fue posible procesar los textos extraídos con el fin de generar rasgos de personalidad que permitieran ir identificando la personalidad en cada una de las distintas ramas, basado en los perfiles obtenidos.

La herramienta desarrollada permitió a los usuarios tener una conversación con un tutor virtual de orientación vocacional a través de una interfaz no tradicional como el Google

Home para voz, o utilizando texto a través de Telegram y Facebook Messenger. Estas conversaciones permitieron generar un cuerpo de texto que al ser procesado por IBM Watson genera un perfil de personalidad que es comparable con los perfiles previamente establecidos para así dar una guía al estudiante basado en su personalidad.

La evaluación del sistema por parte de 72 estudiantes permite conocer de primera mano si consideran el sistema usable y agradable en cuanto a la experiencia del usuario. Estas evaluaciones fueron recolectadas a través de una encuesta que se encuentra en el Anexo 2.

Los resultados obtenidos permiten concluir que el sistema es usable y genera una experiencia de usuario positiva. Es posible afirmar que esta herramienta ayuda a los usuarios a vincularse con el proceso de tomar una decisión vocacional, además estos manifiestan haberse sentido cómodos interactuando con el sistema. La mayoría de ellos estuvieron totalmente de acuerdo o de acuerdo en recomendar esta herramienta, y para ellos fue posible identificar el propósito del sistema.

La interacción entre estudiantes de la ECCI y agentes de inteligencia artificial (basados en texto y voz) proveen una experiencia satisfactoria. Los estudiantes brindaron comentarios positivos que permiten afirmar esto. Por otro lado, se determina también basado en los comentarios de los estudiantes que lo extenso de la conversación que se requiere para obtener un perfil del estudiante es un factor negativo. Sin embargo, esta característica no está directamente relacionada a la usabilidad del sistema.

Entre las características positivas más destacadas, la facilidad de uso resalta ya que un 89% de los estudiantes comparte que el sistema es fácil de usar y un 95% de los estudiantes respondió que aprendió a usarlo rápidamente. Dentro de los comentarios los usuarios destacan, que esta forma de comunicación con el sistema es algo a lo que están acostumbrados

en su día a día y les pareció natural. La experiencia ofrecida, debe inspirar a explorar nuevas en que los sistemas y las personas pueden interactuar.

La evaluación del análisis de personalidad no se encontraba dentro del objeto de estudio del presente trabajo, sin embargo, los resultados que brindó el sistema en cuanto a su análisis de personalidad fueron aceptados por la mayoría de los estudiantes (un 27.78% no estuvo de acuerdo con los resultados). Llevar a cabo un trabajo integral, en el que se considere la opinión experta de la comisión encargada de la definición de los programas de la ECCI, además de profesionales de otras áreas relacionadas a la orientación vocacional, son sin duda los pasos a seguir para mejorar en este aspecto.

Con el fin único de tener una base para trabajo futuro se tomaron datos acerca de la precisión del sistema. Un 36.1% de precisión, no es satisfactorio. Basados en los resultados, es posible decir que existe un sesgo en el sistema por recomendar el enfoque de Tecnologías de la Información.

En un futuro se espera poder contar con diferentes sistemas de decisión que permitan incrementar la precisión del sistema, así como llevar a cabo un estudio longitudinal que permita conocer como la recomendación por uno u otro énfasis varia con el tiempo.

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Anexo 1. Artículo presentado en UCAMI 2017

# Multiplatform Career Guidance System Using IBM Watson, Google Home and Telegram

## A User Experience and Usability Evaluation

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Abstract. Even with the availability of several tests to provide clarity in choosing our career path, the decision remains a tough one to undertake. Most of the available tests are either monotonous, resulting in a tedious effort to go through them entirely, or are just plain boring. In this paper, however, we present a new and different approach to career guidance systems. We use Google home as a speech-based interface and Telegram as a text-based interface to generate a conversation between the users and a bot for career guidance. The idea is to provide an easy and friendly interface with an interactive user experience while gathering the required data to provide career guidance. To evaluate the system, we used the University of Costa Rica's Computer Science and Informatics Department scenario. In this scenario, students must decide between three possible emphases: Software Engineering, Information Technologies, and Computer Science. A usability and user experience evaluation of the system was performed with the participation of 72 freshmen.

Keywords: Career Guidance, IBM Watson, Personality traits, Google Home, Conversational Interface, Telegram

## 1 Introduction

Career guidance is a complex task that has a high impact on the life of people undergoing a career selection process. Career guidance includes informing, advising, assessing characteristics, teaching to enable, networking, managing, mentoring and interviewing to extract information about a person [1]. Moreover, career guidance is a process that requires the

involvement of multiple people and can't be effectively carried out by a single guidance practitioner [2].

For many years, companies and researchers have developed career guidance tools based mostly on online surveys or traditional computer-based interfaces. These tools, however, are usually used for self-assessment and are an add-on to the much bigger process of career guidance.

In this paper, we present a career guidance system, focused on the IT domain (i.e., helps to select between software engineering (SE), computer science (CS), and information technologies (IT) management), which uses Google Home and Telegram to extract information from the user to create an assay and with it perform an analytical comparison of personalities using IBM Watson personality models.

The focus of this research emerged due to the separation of the CS career at the University of Costa Rica (UCR) into three different emphases. In order to test our career guidance system, we used three profiles based on those three academic emphases.

The system was built using model driven development and API.AI, a development tool that allows creating natural language conversations and provides a processing engine to easy the creation of the dialogues [3].

The system user experience was evaluated with the help of seventy-two incoming Computer Science students and the results were promising.

This document is structured as follows: Section 2 shows related work, Section 3 describes the proposed systems, Section 4 explains how the system works, Section 5 describes the evaluation and the results, and Section 6 includes conclusions and future work.

## 2 Related Work

Different technological approaches have been explored to support the career guidance process. This section describes some of those efforts.

Games are an interesting way to engage and extract information from people starting their studies [4][5][6].

In their work, Shi and Shih [4] use a current version of the Holland Codes [7] to define career paths. Their game is based on interactive fiction and simulation. The goal of the game is for users to understand the occupational characteristics and difficulties to provide a comprehensive understanding and ultimately help them improve their career decisions.

Dunwell, Lameras, de Freitas, Petridis, Hendrix and Arnab propose a similar approach in [5] that consists of a serious game with elements that promote professional development, decision making and understanding the dynamic nature of the job market. Authors, however, do not describe the theory used for the development of the tool.

Waypass, proposed by Garcia, Serra, Membrives and Juarez [6], uses a different approach to gaming. It provides an experience using scenarios and storytelling to motivate users. Their proposal is based on the self-determination theory [8] and uses concepts such as auto-discovery, inspiration, transformation, and exploration to guide the user through the career selection path.

Other, simpler approaches have also been implemented, for instance [9] proposes L4All, a system that aims to support the exploration of experiences, so to reflect on them while making decisions. It uses different categories including educational, occupational and personal. The goal of this system is to find the qualifications of an individual in a domain of expertise to determine if it fits the user.

Other systems are more focused on the career guidance method than the user experience method, which involves the overall usability of the system. For instance, [10][11] delve in how to use big data tools and fuzzy logic to facilitate goal alignment and generate career path recommendations.

Other works, such as [12], focus on comparisons of performance over classification algorithms applied to vocational orientation (i.e., focused on the machine learning part of the problem). Moreover, clustering algorithms have been applied to classify students based on the likeliness of their profile with other students that already picked a career [13]. Expert systems have also been developed for vocational decisions [14].

Similar works, to the one presented in this paper have also been performed. For instance [15] presents a computational platform that makes psychometric questions for about 40

minutes, and then generates an analysis that is sent as a report to the student through email. The report includes personality analysis, aptitudes, skills, motivations, and preferences. The authors describe that this analysis is made through an artificial intelligence engine capable of getting conclusions as a professional would.

Our approach differs to the projects presented in this section by two main characteristics. The first one is that our development is based on natural user interfaces using a chat-like communication or conversation (speech). The second one is that the evaluation is focused on usability and user experience rather than the technical part of the issue. This approach is based on engaging the young participants and determining their satisfaction levels while using the system.

## 3 System Overview

This section describes the system, its component, and technologies applied to it. This includes the user interface, the proxy service (API.AI) used for communication and dialogue computation, and the personality evaluator (IBM Watson). Figure 1 shows a graphical system overview including all these components.


Fig. 1. System architecture and software used

## 3.1 User Interfaces

The idea behind this project was to create a natural and intuitive way to conduct a conversation that would allow the extraction of an assay, which could be compared with others stored in our database. To achieve that, we built natural interactions, simulating a human conversation using Google Home (speech interface) and Telegram (text interface). Telegram was used in a chat-like format.

### Google Home

Google Home is a voice activated speaker manufactured and commercialized by Google [16]. It runs a version of Google Assistant, an intelligent personal assistant designed to allow conversational usage [17]. Google Assistant uses a natural language user interface to answer questions, make recommendations, and perform actions by delegating requests to a set of services. Moreover, it delivers information to users predicting their requirements.

Some of the promotional commands for Google Assistant include: "Ok Google, Remind me to pick up a birthday card", "Ok Google, Book me a table for 6 at Quartino for 8:30", "Ok Google, Who invented sushi?" [17].

In this project, Google Home is used to interact using voice with the user. A set of questions are asked and the results computed and transcribed to be processed.

### Telegram

Telegram is an instant messaging service that allows users to exchange texts, photos, videos, stickers, audios, and files. Telegram has developed clients for mobile devices and other operative systems in traditional PCs [18]. The reason to use Telegram is because it allows third-party developers to create bots. These bots can perform different activities, such as simulating a conversation. In this project, a bot is used to simulate a conversation with the user and asked the required information to perform a personality analysis.

### 3.2 Natural Language Interface (API.AI)

In this project, API.AI was used to develop a bot that generates the dialog using natural language, which is deployed in both Google Home and Telegram. API.AI is capable of recognizing entities and intents inside a text and transform it into actionable data [3].

A set of 18 intents were added to the career guider agent. Recognition of entities like dates, names and locations were used.

### 3.3 Webhook (Node.js)

A webhook is a common expression to refer to an HTTP POST action that occurs when something happens. In this system, the webhook is used to process the information gathered from the user through API.AI and then send that information to IBM Watson.

Once Watson returns the analyzed profile of the user, an analytical process takes place in the webhook to compare this profile against the different IT domain's profiles. This in turn, defines the most similar profile between a user and an IT domain.

### 3.4 Fulfillment service (IBM Watson Personality Models)

The core of this system is the personality model provided by IBM Watson [19]. Watson is an artificial intelligence system capable of several functions such as processing data in natural language or performing recognition patterns, with many more uses. In this project, we are using the Personality Insights provided by Watson.

Each time a user interacts with the bot, it transcribes the conversation into text that is then compiled at the end of the session. Later, the gathered text is sent to IBM Watson to execute the personality analysis. In total fifty-two traits of a personality are retrieved by Watson Personality Insights service.

### 3.5 Personality database

The records of this database are in the form of summarized outputs of the Watson personality analysis. Ten profiles of each IT domain under study were gathered from the internet, and the personality evaluation was performed using the about me section in their professional blogs. For each domain, the fifty-two traits of each profile were summarized along with their partners inside the domain to generate a representative profile.

## 4 System Functionality and Performed Analysis

This section describes the performed analysis and explains how the system works when the components are assembled.

### 4.1 Providing career guidance

As it was described before, the system is available in two platforms: speech-based (using Google Home) and text-based (using Telegram).

To offer a personalized and good user experience, the bot asks the users for their name and a brief introduction about themselves. The dialog consists of a set of open-ended questions made by the bot.

The idea behind the dialog is to encourage the user to provide information with relatively long answers (i.e., avoiding yes/no answers).

The bot can recognize the contexts of the conversation and handle the dialog accordingly. Once all the questions are answered, the analysis is performed and the results are shown.

The result is a description of the user's personality and a recommendation of the domain that would best suit the user according to their personality. An output example is:

> Daniel, your profile analysis is ready. According to my professional lecture of yourself, the career path that I advise you is: Computer Science.

This is your profile summary: You are shrewd. You are energetic: you enjoy a fast-paced, busy schedule with many activities. You are philosophical: you are open and intrigued by new ideas and love exploring them. You are authority-challenging: you prefer to challenge authority and traditional values to help bring about positive changes.

Your choices are driven by a desire for discovery. You are relatively unconcerned with both tradition and taking pleasure in life. You care more about making your own path than following what others have done. And you prefer activities with a purpose greater than just personal enjoyment.

## 4.2 Performed analysis

This section describes the IT domains profiles, characteristics and how users' personality was analyzed to propose a recommendation.

### Computer Science and Informatics School Career Paths Personality Traits

A general overview of the big five personality traits for each IT domain is shown in Table 1. On the other hand, Table 2 details which are the most different traits of each IT domain.

Table 1. IT Domain profiles with the five main personality traits' percentile values.

| Personality Trait | Software Engineering | Computer Science | Information Technologies |
|---|---|---|---|
| Openness | 87.1% | 79.5% | 90.3% |
| Conscientiousness | 50.9% | 54.0% | 49.8% |
| Extraversion | 30.7% | 15.5% | 44.1% |
| Agreeableness | 8.8% | 6.8% | 7.6% |
| Emotional range | 61.1% | 65.0% | 66.3% |

Table 2. Most different traits between IT domains. Computer Science as CS, Information Technologies as IT and Software Engineering as SE.

| Personality Trait | Domain | Direction | Detail |
|---|---|---|---|
| Practicality | CS | Less | Have a desire to get the job done, a desire for skill and efficiency, which can include physical expression and experience. |
| Liberty | CS | Less | Have a desire for fashion and new things, as well as the need for an escape. |
| Altruism | IT | Most | Find that helping others is genuinely rewarding, that doing things for others is a form of self-fulfillment rather than self-sacrifice. |
| Openness to change | CS | Less | Emphasize independent action, thought, and feeling, as well as a readiness for new experiences. |
| Challenge | SE | Less | Have an urge to achieve, to succeed, and to take on challenges. |

According to the analysis and summary performed by Watson over our personality database, we have concluded that computer scientists are on average skeptical and inner-directed. On the other hand, software engineers represent a shrewd and inner-directed profile. Finally, the information technologists showed to have a shrewd profile.

For Watson, our mean found was that the computer scientist is independent, the software engineer is trusting of others and the information technologist is energetic.

A common quality of all the profiles is to be authority-challenging and philosophical. Also for Watson, all the profiles tend to be unconcerned with both taking pleasure in life or tradition, they prefer to make their own path rather than follow what others have done.

## Analyzing Users' Personality

One could say that any user could use Watson tools to get their profile analysis and make a comparison between his profile and other profiles. To make an objective comparison, however, we decided to use the Euclidean distance to find the nearest profile in a multidimensional space. Equation 1 shows how this distance is calculated [20].

$$(p, q) = d(q, p) = \sqrt{\sum_{i=1}^{n}(q_i - p_i)^2} \quad (1)$$

The distance between the user profile p and every profile q is calculated. At the end, the nearest profile is selected and showed as the system's recommendation.

By using this method, we are getting a pseudo-ranking of recommendations, something that is useful if we would like to extend this system to a broader scope.

# 5 Evaluation

The evaluation of this project is focused on the user experience. Even though the career paths are very important, several studies have delved into this topic, therefore, we will focus on the usability and overall user experience.

## 5.1 Procedure

Seventy-two freshmen of the CS School at UCR tested the application. As they represent the real target of the application, their assessment of the user experience is the closest to the real perception users will have.

At the evaluation moment, Google Home only supported English. To test both experiences we asked English spoken students to test the Google Home bot. The rest of the students tested the bot trough the messaging app. The length of the interaction between the students and the bot was on average less than 12 minutes. Once the interaction ended, the students filled an evaluation of usability and user experience survey.

The main source of questions for the survey used in this work is the System Usability Scale [21]. The survey included the following questions:

- Close-ended questions
  - I think that I would like to use this system frequently
  - I found the system unnecessarily complex
  - I thought the system was easy to use
  - I think that I would need the support of a technical person to be able to use this system
  - I found the various functions in this system were well integrated
  - I thought there was too much inconsistency in this system
  - I would imagine that most people would learn to use this system very quickly
  - I found the system very cumbersome to use
  - I felt very confident using the system
  - I needed to learn a lot of things before I could get going with this system
  - I felt the system is exciting
  - I felt the system is innovative
  - I felt the system is motivating
  - I felt the system is attractive
  - I would recommend the usage of this system to my friends
- Open-ended questions
  - What is the main goal of the system?
  - What do you like least about the system?
  - What do you like the most about the system?
- Describe the system with 3 words
- In a range from 1 to 10, how do you evaluate the system?
- What career path you want to follow?
- What career path did the system recommend you?

## 5.2 Results

This section presents the results of the evaluation performed. The results include responses to the System Usability Scale questionnaire and the rest of the questions asked. One of the main question asked was: What is the main goal of the system? No information regarding this was provided before the evaluation. Figure 2 shows the main results for this question.

In Figure 2, the response with more support by the participants was to support a career choice, we believe that this response is associated with a guide more than a recommendation. The second response was to define the career path, we interpret this as a recommendation (i.e., the system decides for the user). The third response in significance was to analyze user personality. Other responses in less significance were combined into one category. They included: to gather information, to help in complex tasks, to talk, and to get a conclusion for a future decision.

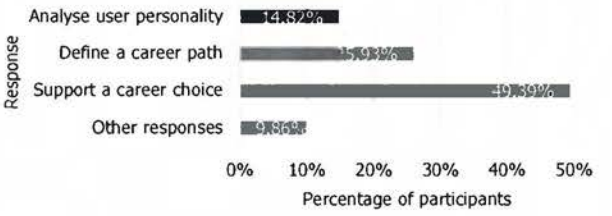


Fig. 2. Responses of participants to the question: What is the main goal of the system?

The responses to the System Usability Scale questionnaire were overall positive. Participants strongly agreed with the easy to use system and they also commented that it was easy to learn. Even though the participants agreed that the system is not complex and does not require any previous knowledge, it still, however, was found to have some inconsistencies during the sessions. Figure 3 shows the results of this part of the survey.

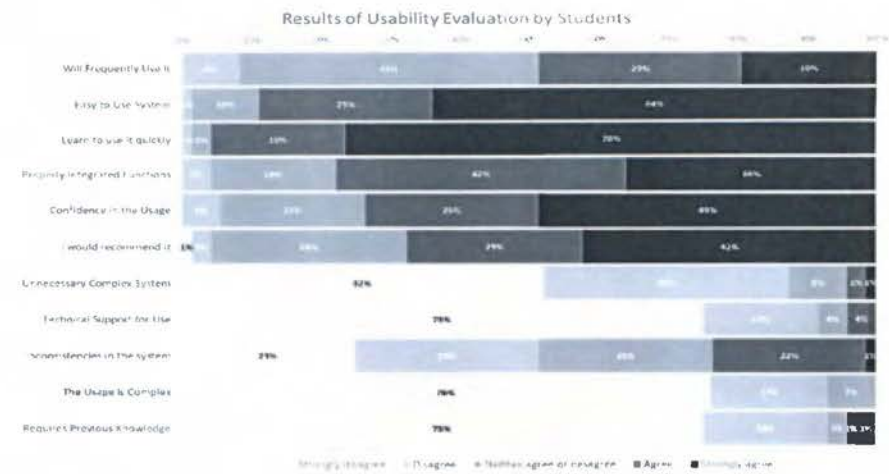


Fig. 3. Responses to the System Usability Scale.

Another question was: What do you like least about the system? The main response here was that participants did not like the personality analysis (27.78% of the respondents).

The top usability issue reported by 9.72% of the respondents was that the speech-based system cut their voice when they were talking. Other users (6.94%) only reported that the system had bugs.

Focused on the conversation and the main goal of the system, 9.72% did not like the questions asked by the bot. Another group of users (2.78%) did not like that the system required long answers, and 4.78% did not like the extension of the session.

Some other issues reported by the participants include: the system changed the context of the questions, the analysis of the responses was inadequate, the system was monotonous, and the system was too formal. Moreover, they did not like that they weren't allowed to extend their responses once the question was asked and the first response was given. All these issues correspond to 38.28% of the respondents.

In contrast to the 'What do you like least about the system question,' we also asked, what do you like the most about the system? The top answers to this question included: easy to

# 6 Conclusion and Future Work

The undergraduate CS curriculum at UCR offers three career paths. We developed a career path advisor using tools provided by Watson. In addition, we evaluated a speech-based version using Google Home and a text-based version using Telegram. The evaluation was focused on user experience.

The results allowed us to conclude that the system is usable and generates a good user experience. From our point of view, this tool will help users to get more engaged in the process of choosing a career path. Moreover, the students were comfortable interacting with the system. Most of them agreed or strongly agreed to recommend it. The participants were also able to correctly identify the system's purpose.

One of the most disliked attributes of the system was the extent of the conversation, as the users perceived it as a long process. This attribute is not directly related to the system usability. Therefore, the interaction between CS students and bots (based on speech or text) supported by artificial intelligence provides a satisfying experience.

The students chatted naturally using both interfaces. Eighty-nine percent of the students agreed and strongly agreed about how easy was to use the system. Ninety-five percent learned to use it quickly. This experience should inspire the exploration of novel means of interaction between people and systems.

Furthermore, our system uses a personality database component to perform a profile analysis using Watson. Although the personality database was not directly assessed, the results were accepted by the students (only 27.78% of the participants expressed that they did not like the personality analysis). The personality database could be enhanced to get more accurate profiles.

Data concerning the accuracy of the system was taken although it was out of the scope of this study; It was done to have a base for future work. A 36.1% of accuracy is not at all satisfactory. Moreover, based on data there could exist a bias of the system to select Information Technologies path.

Given the characteristics of the information, we conclude that the SE profile had some issues, hence was not recommended properly.

In the future, we would like to test different decision backends to improve the performance of our current profile matcher. Moreover, a longitudinal study could be conducted to learn about how the career path recommendation varies over time.

As a reference to future work, a combination of these new interfaces and traditional mechanisms for career guidance could be evaluated to determine if a more natural interface affects the results of automatic career guidance systems.

Since the division of the CS emphases has taken place only this year, it is a premature problem.We would like to gather data related to the decisions made by students that participated in the test, to know the proper metrics required to measure the performance of career path recommendation systems directed to CS School students at the UCR.

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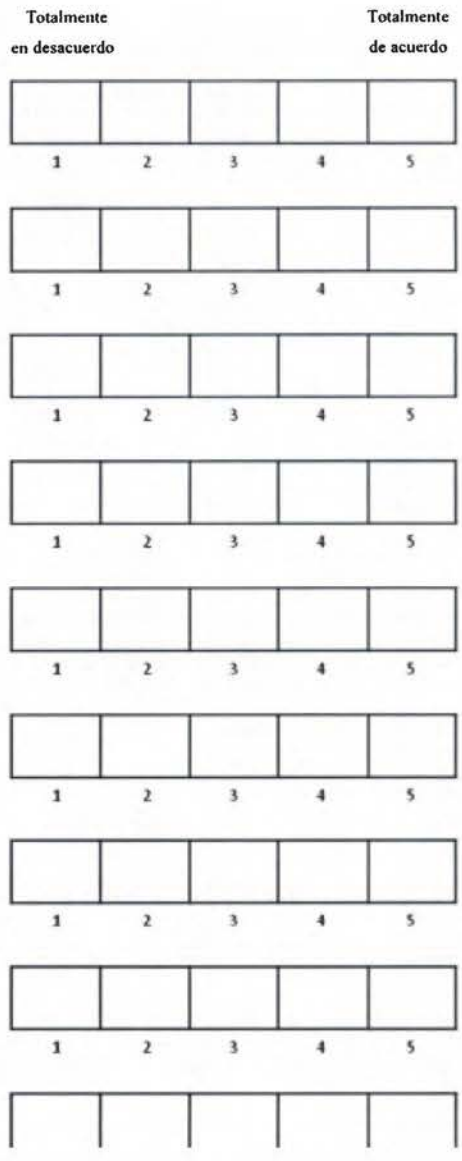
Anexo 2. Cuestionario para la evaluación

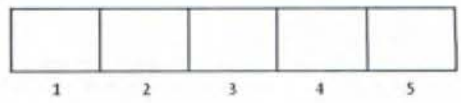
Evaluación de Usabilidad

Sistema Recomendador de Énfasis de la ECCI-UCR

13 de junio de 2017



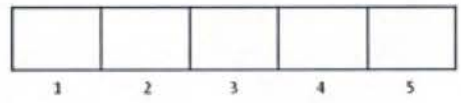
10. Necesito aprender muchas cosas antes de poder usar este sistema



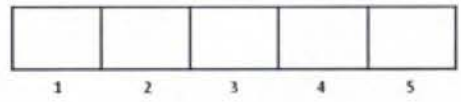

11. El sistema me pareció interesante


Totalmente en desacuerdo — Totalmente de acuerdo

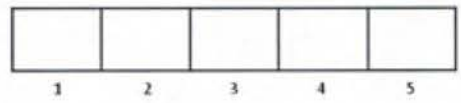
12. El sistema me pareció emocionante



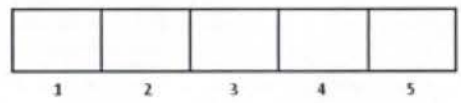

13. El sistema me pareció innovador



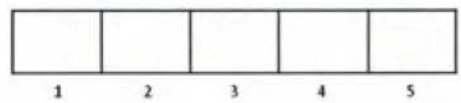

14. El sistema me pareció motivador




15. El sistema me pareció atractivo




16. Yo recomendaría el uso de este sistema a mis amigos




¿Para qué sirve el sistema?

¿Qué fue lo que menos le gustó del sistema?

¿Qué fue lo que más le gustó del sistema?

Describa el sistema en tres palabras: _____

En un rango de 1 a 10, ¿cómo evalúa usted el sistema? _____

Nombre: Carné: