

Employee Recruitment: Question Formation for Employment Interviews based on Facial Cue Analytics

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Abstract

Prior research works have revealed that a relationship lies between a gainful interviewee and facial cues exhibited during the interview process. This study is focused on the formation of the questions to examine the interviewee which will use nonverbal behavioral cues presented. From nonverbal behavioral factors, 'Facial expression variation' was taken into the consideration with the assistance of a facial expression analysis tool. As such, this research proposes a novel approach in question formation for the assessment of interviewees. In the data collection and analysis phases of the study, qualitative and quantitative approaches have been followed. These approaches were used to identify the personality traits required in the IT related recruitments and to identify the traits that employed IT personnel already possess. Mock interviews were conducted to identify the valid questions that show a high sensitivity with facial expression variations while a tool was used to extract facial cues of the candidates. Seven primary emotions were captured with this approach during the interview. The facial emotions of joy, anger, contempt, disgust, fear, sadness, surprise were identified during the interview period which provided the percentage values for the emotional engagement of the candidate. Based on the video analytics, five questions were reported with a high emotional engagement values, three with an average variation level and remaining did not have a significant variance in candidate responses. During the final phase of this research, a cross reference analysis was conducted. For this analysis, data sets of emotional engagement were cross checked against the rankings given by the human raters regarding the extent of the question and response in total helped them to take the hiring decision. The evaluation of the results was done by comparing the result set obtained through video analytics with Human Rater result set obtained. Therefore, this research study and its suggested scientific approaches would assist the recruiters with identifying the set of questions which affect the recruitment decisions of their organizations in future.

Keywords: Employment Interviews, Question Formation, Facial Expression Analysis, Nonverbal Behavioral Patterns, Personality Traits

INTRODUCTION

The employment interview is a common process used in all the organizations where job applicants are evaluated by interviewers for a selected job position. The interviewer will compare several applicants considering the parameters such as interaction, knowledge, skills, and personality characteristics in order to select the most suitable person for the job (Wiesner and Cronshaw, 1988). This comparison will be solely based on the recruiter's opinion on the applicant's verbal and nonverbal behavior during the interview. In face-to-face interviews, the meaning of spoken words is known as the verbal behavior. The nonverbal behavior can be either vocal cues or visual cues. Features like tone of voice, intonation, and pauses create variations in vocal cues while head movements, postures or facial expressions create variations in visual cues (Knapp, 1978). Studies have proven that as most of the nonverbal cues are outputs of unconscious processes. Therefore, people have the ability to interpret these cues with a significant accuracy level. Studies on the nonverbal behavior in employment interviews are not a new research domain for the social and organizational psychology. In the beginning, due to the unavailability of technology, the studies were conducted only on using the human annotations of nonverbal cues. However, currently researchers have video and audio analytic tools which can be used to automatically and accurately extract the nonverbal cues to assist researchers in social psychology studies (Gatica-Perez, 2009). Hence this can be aided in identifying questions that lead to exhibit higher level of emotions through facial expressions by candidates. As such the unconscious processes, can be used for the evaluation process of the candidate.

Therefore, in this study the research problem is constructed around the question of, "*Whether it is possible to identify any correlation between different interview questions asked during the employment interviews, with the facial cue variations of interviewees while they respond to them*". Furthermore, it was expected that this research findings will lead in to the consideration of facial cues, when forming interview questions for future employment interviews.

RELATED WORK

EMPLOYMENT INTERVIEWS IN ORGANIZATIONAL AND OCCUPATIONAL PSYCHOLOGY

Many prior researchers have experimented on the employment interviews in various occupational and organizational psychology domains. One of the significant related studies of

this field is investigation on the different ratings that the same applicant receives from the different evaluators and job recruiters (Huffcutt et al., 2001). Moreover, research work has also conducted on identifying the correlation between the ratings that an applicant received in his job interview, with his job performance after he is employed in the same organization (Posthuma et al., 2002). Researchers have also used personality models such as "Big Five" to identify the relationship exists between the personality traits and the job performance of the employees (Rothmann and Coetzer, 2003).

There are many research work conducted on the non-verbal behavioral patterns and its impact on the job interviews as well. When discussing about the nonverbal interactions, the facial expressions such as direct eye contact, smiling and nodding are also included. It has also proven that with interviewees with more facial expressions has relatively high capability in getting hired than the applicants who do not (Forbes and Jackson, 1980). This finding has been confirmed by one of the other similar studies which has proved that the applicants who got rejected in job interviews had produced comparatively less facial expressions compared to the ones who did (Anderson and Shackleton, 1990). This positive co-relation between applicant's nonverbal behavior and hiring decision is based on the immediacy hypothesis which suggests that, the immediacy nonverbal behavior patterns of interviewee such as eye contact, nodding and facial expressions lead in to a positive effect on the recruiters (Imada and Hakel, 1977).

Employment Interviews in Social Computing

Recently there are many studies that conducted on investigation of the use of computational approaches in analyzing the nonverbal behavior. In the organizational context, the relationship between vocal spectrum and the job negotiations skills have investigated using a simulated scenario between a vice president and a manager of a company (Curhan and Pentland, 2007). As the discussion was consisted of conflicted arguments, a scoring system was designed to reward points to both parties based on the audio nonverbal cues captured in their discussion. Especially related to the employment interviews, a computational approach was used in the study of Big-Five personality traits in self-presentations (Batinca et al., 2011). In this study, 89 participants had to do a self-introduction in front of a computer which was similar to video resumes. The audio nonverbal cues such as prosody and video nonverbal cues like head and hand movements were extracted from the videos and used to predict Big-Five personality traits using classification techniques. The findings of this

research suggested that the positive correlation is existed between some personality traits and the applicant's ability in getting hired. Based on another recent research work, a system was proposed to create an employment interview simulation virtual environment using a virtual agent (Baur et al., 2013). The environment was consisted with a virtual agent played the role of a recruiter and it has the ability to react and adapted to the applicant's behavior using the signal processing techniques. The proposed system was capable of capturing the nonverbal behaviors of nodding, head movements. Hand gestures, postures, leaning forward/backward, voice variations of the applicants.

Facial Expression Analytics

The Facial Action Coding System (FACS) is a framework for analysing facial expressions of humans by identifying movement of facial muscles (Cohn et al., 2006). FACS has the ability to uniquely identify the seven universal facial expressions (anger, contempt, surprise, fear, joy, sad and disgust) in static image sequences. Computer Expression Recognition Toolbox (CERT) is a tool which evolved from the FACS which has the real-time image processing capability (Littlewort et al., 2011). The process flow of CERT includes face detection, feature detection and face registration (Teijeiro-Mosquera et al., 2015). "Emotient" tool which has been used in this research is evolved from both CERT and FACS. It has been used in most of the recent research studies conducted on facial expression analytics. "Emotient" currently provides more than 90 percent accuracy with its video analytics (Emotient, 2016). Features of this tool are attention, engagement, sentiment levels, gender identification, categorization based on seven base emotions. All these features are available in Emotient by using the video data such as facial positioning and land marks, facial angle to camera and 20 Facial Action Units (Emotient, 2016).

DATA COLLECTION

Data collection phase of this research study is consisted of 3 sections. Those are conducting interviews with the industry professionals who handle the recruitment process of selected IT companies, conducting an online survey among the employees who play different job roles in the IT industry to identify different personality traits they possess and conducting mock interviews to identify the co-relations between the interview questions and their facial cues.

Conducting Interviews with Industry Professionals

Selection of Industry Professionals: This research is focused on the employee interviews conducted for “Business Analysis and Consulting” positions in Information Technology domain. Therefore as shown in Figure 1, all the industry professionals who were selected to this study had more than five years of experience in handling and participating in the business related recruitments in their organizations. In order to identify the personality traits that recruiters are considering when hiring the business analysts, interviews were conducted with 12 experienced industry professionals from 05 well reputed IT organizations of Sri Lanka (Slasscom.lk, 2016). Therefore, each interview session was consisted with maximum number of 3 professionals, representing their respective organizations.

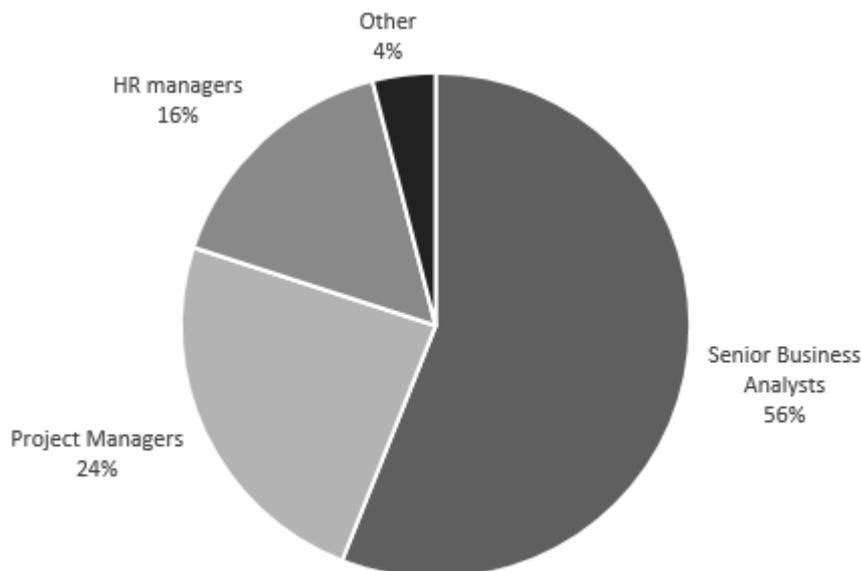


Figure 1: Categorization of Participants

Interview Procedure: The interviews were steered through following topics.

- The ongoing recruitment procedures of their companies
- BA job roles and day-to-day activities in client handling process
- Personality characteristics for a BA job position

As its required from the industry professionals to express their opinions in depth while the researchers were required to keep the interviews within the parameters of the study, “guided unstructured interview“ approach has been used as it was identified as the most appropriate way of conducting these type of interviews (Berry, 1999). Each interview session was carried out by the co-interviewers (All 3 members of the research team) which lasted approximately

45 minutes. During those sessions, questions asked from the industry professionals were as follows;

- What are the personality characteristics that you look in an applicant when interviewing?
- Can you judge a person in an interview by considering his or her facial expressions?
- Can you describe required personality/ unique characteristics for a successful business analyst?
- What are the specific questions you ask to understand the personality of the applicants?

After getting consent from the participants, the responses were recorded and transcribed by the researchers. The transcripts were prepared using the HyperTRANSCRIBE tool (Administrator, 2016) which is being used in many other qualitative researches.

Interview question identification based on the Personality Traits: In order to proceed with the data gathering phase, the specific interview questions that recruiters are using to assess the above personality traits of the applicants had to be identified. Therefore a question bank which consisted of 12 questions were prepared with the assistance of the industry professionals. Some of the questions are designed specifically in a behavioral and emotional/expressive manner by involving bipolar situations of certain scenarios which could be used to assess the Emotional Stability characteristics of the candidate.

Conducting an Online Survey

An online survey (questionnaire was circulated through online) was conducted, in order to understand the characteristics and personality traits of Business Analysts and other Software Services employees who does higher level of communication and require interpersonal skills as competencies, when performing their job roles daily. Participants of this survey were pre-screened and only those who matched our target profiles were allowed to complete the survey. In the prescreening process, it was ensured that all the participants possess at least one year of experience in their respective fields. To improve the flexibility of the survey it was designed in a way that after submitting a response (only one response from each) submitted answer could be altered. This online survey was used to collect the actual characteristics occupy in the already recruited IT employees. The survey was distributed among Business Analysts, Consultants, IT Sales and Marketing employees, System

Architects, Quality Assurance and Software Engineers to analyze the variation of the personality traits among the job roles. The survey was prepared based on extracted traits from the Goldsberg research which has a scoring of the personality sub attributes that any individual would possess (Goldberg, 1992).

Conducting Mock Interviews

This research is targeted on the job positions in IT industry which require high level of communication skills compared to the other job roles. Therefore, it was ensured that all the selected participants possess more than six months of relevant work experience in job roles which require much communication skills such as IT Business Analysis. Nationality of all the participants was Sri Lankan and their first language was not English. All the participants were in the age range of 25 to 28 years. Before the beginning of each interview, all the participants were provided with adequate information about the interview scenarios along with the clear instructions specifically mentioning that it will be a non-technical HR interview. In addition to that, all the interviews were conducted in English language. A consent form had to be completed by the participants upon arrival at the interview location while their privacy concerns were also taken into consideration before the initial proceedings. They were also well informed about the video recordings of their interviews which would be solely used for academic research purposes while distribution outside the research team or public display of recordings were completely prohibited under any circumstances. Moreover, participants were given the opportunity to withdraw their consent at any time. Interview scenario was given as per the participant's preferred organizations and interests towards the job role(s) considering his/her past and present experiences and future expectations.

Interview Questions: Interview questions were designed and validated with the help of external advisors who are experts in Psychology, Sociology, Human Resources and Business Analysis domains along with more than 5 years of interview panel experiences. All these interview questions were designed in a non-technical manner, so that participants do not require too much of preparation or prior knowledge on the domain before the interviews. The sequence of questions is listed below;

1. Tell us about yourself
2. What are the motivational factors for you to do a great job?
3. What can you offer us that someone else can not?

4. Are you good at working as an individual or team?
5. If your previous co-workers were here, how'd they recommend you?
6. Has anything ever irritated you about people you've worked with?
7. Is there someone you felt difficult to work with?
8. What are three things your former boss would like you to improve on?
9. Brief us why we should hire you?
10. Tell us about an accomplishment you are most proud of?
11. Tell us an instance when you made a mistake that you regretted.
12. What is your salary expectation?

In order to make sure that each interview is followed under similar structure and involved in specific situations, a semi-structured behavioral design has been used which could cover the selected personality traits perfectly.



Figure 2: Female participants during the face-to-face interviews

Interview Setup: In this research study, 36 face-to-face mock interviews were initially recorded. Those 36 interviews were consisted of 25 male participants and 10 female participants. These interviews were conducted by the co-interviewers of the research team inside the University Studio room which was a noiseless environment with an appropriate level of lighting. As it is clearly exhibited in the Figure 2, during the interview video recording it was made sure that participants are comfortable with the proper seating arrangements and lighting in order to capture their facial emotions perfectly. Both interviewee and interviewers were facing each other in 3 feet distance, sitting on the chairs in same height separated by a table.

DATA ANALYSIS

Analysis on Interviews with Industry Professionals

In order to identify the personality traits and the related questions, a comprehensive thematic analysis was conducted on the interview transcripts which were created based on the responses received from the industry professionals. This technique was used to derive the themes and group them in a meaningful and organized manner. In this research, it was decided by the researchers to consider the traits which were mentioned at least 3 out of 5 interview sessions as the most stated commonly required characteristics. Therefore, based on the above analysis, communication, analytical, problem solving, decision making and negotiation skills were identified as the generic set of skills that required for a business analyst. Other personality related characteristics mentioned by the professionals were segmented based on the Big Five personality model as given in Table 1.

Table 1: Results of Thematic Analysis

Big Five personality dimensions	Extroversion	Agreeableness	Dependability	Emotional Stability	Intellect
Derived themes	Talkative Energetic Active Passion	Cooperative	Organized Responsible Practical	Calm Stable Confidence	Reflective

Analysis on the Online Survey

By analyzing the online survey conducted among the IT professionals, certain personality variations among the job roles of software industry were identified. Based on the analytics, the job positions were divided into two main categories considering the interaction level with the external stakeholders of their companies. Job positions that required less interaction were Software Engineering, Quality Assurance engineering and technical writing. The IT product/service marketing and business analysis job positions were required high level of interaction with external parties. Average, median, mean and standard deviation was used for the analysis purpose of this data set. Information related to the 35 sub attributes that were taken from Goldsberg's Research was analyzed. Therefore, the results gained through that

survey also prove that the most of the traits mentioned in the industry professional interview are actually inherited by the participants of the online survey representing the Business Analysis domain. Table 2 clearly provides summarized results on the findings of the online survey conducted.

Table 2: Results of the Online Survey

Big Five personality dimensions	Extroversion	Agreeableness	Dependability	Emotional Stability	Intellectual
Commonly inherited traits among BAs	Talkative Extraverted Passion	Cooperative	Organized Responsible Thorough	Stable	Analytical Intelligent

Therefore, in this research *passion, cooperation, confidence* and *emotional stability* have been chosen as the personality traits which need to be further studied to find out the correlation with facial cues of the interviewees.

Analysis on the Mock Interviews

In order to analyze the video clips recorded on the mock interviews conducted, “Emotient” online tool has been used. All the video recordings were segmented in to 455 clips and analyzed through this tool. This tool has the ability to monitor the twenty action units in the face and generate a frame by frame numerical data sheet on the emotional variation of the person. After aggregating the values of the emotions and head movements the system generates a report on the emotional engagement, attention and sentiment values. A numerical value sheet and a graphical representation of emotion variation are being generated for each of those traits. The questions that showed more emotional engagement values were identified after the statistical analysis.

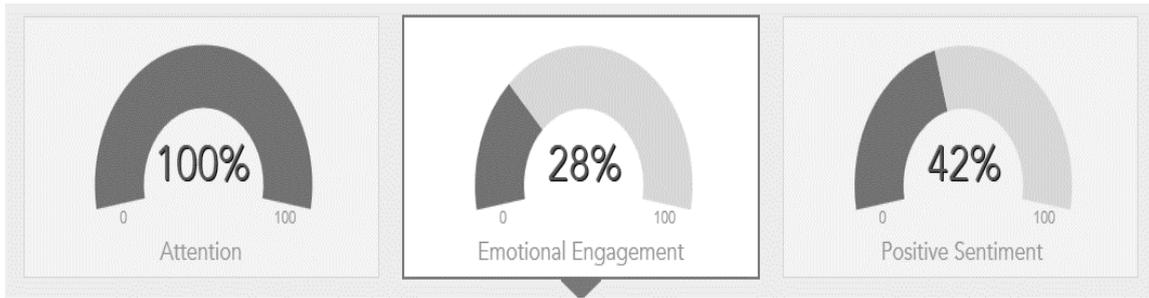


Figure 3: Scaling view on overall percentages obtained for Attention, Emotional Engagement and Positive Sentiment for a 30 seconds' video answer clip of a candidate

Figure 4 displays graphical variation value for each frame was displayed by the system generating a numerical value report for the emotional engagement. The scale of emotional variation was generated considering ten emotional features to the system.

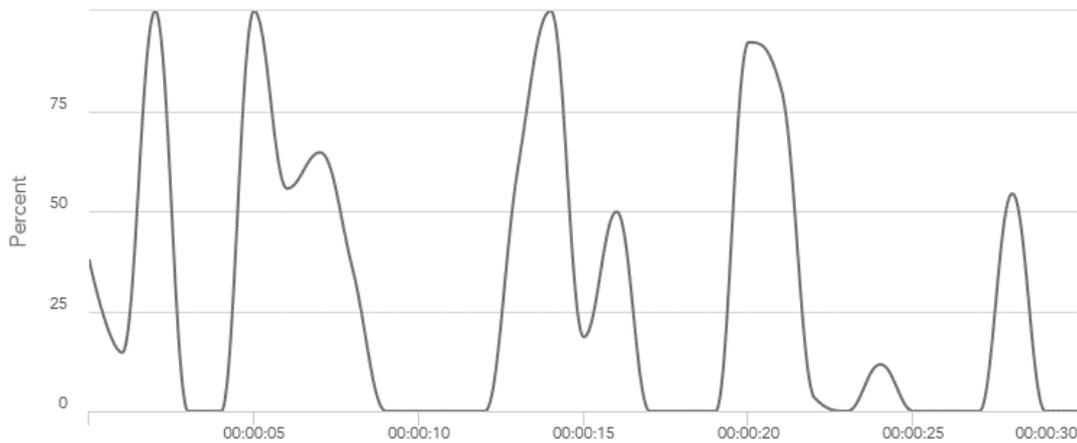


Figure 4: Graphical variation of Emotional Engagement by second

By obtaining analyzed movement details of twenty action units, ten emotional details were generated in the system for each frame. Figure 5 displays the emotions considered in generating the aggregated value for the emotional engagement.

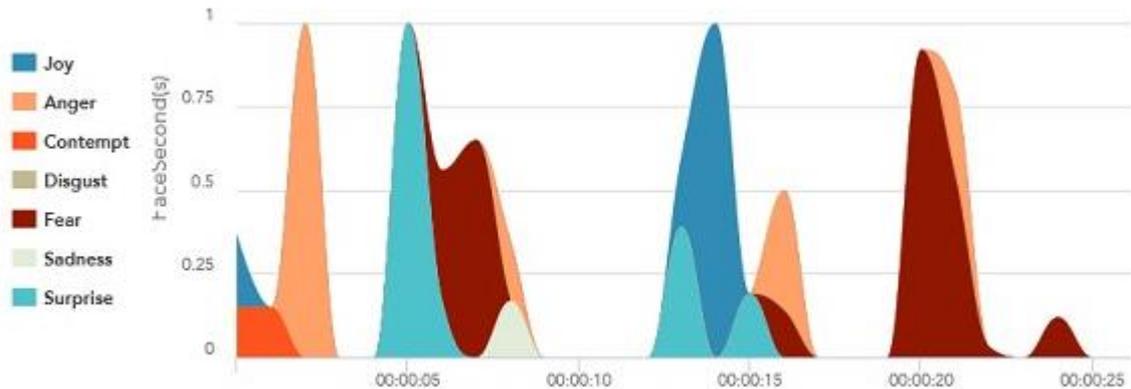


Figure 0: Graphical variation of Emotion detection by second

The details that were generated for each clip was used to compare and to develop a statistical analysis table of numerical data showcased against each question. For each question candidates produced different set of emotional engagement values. The average value of the emotional engagement was included in the statistical analysis data model. The questions that showed a higher number of total values were marked for the cross referencing process in the evaluation phase.

RESULTS

Based on the Emotient video analytics, results of four questions have shown relatively high emotional engagement values from the candidates. Two questions have shown moderate variation level and remaining questions did not have any significant variance.

Table 3: Average Emotional Engagement values (%) achieved for each question

<i>Personality Trait</i>	<i>Questions</i>	Emotional engagement Value (%)
Passion	Tell me a small description about yourself?	30%
	What motivates you to do a good job?	60%
	Tell me about an accomplishment you are most proud of?	43%
Confidence	Explain why I should hire you?	70%
	What can you offer us that someone else can not?	64%
	Let's talk about salary, what are you looking for?	35%
Cooperation	Are you good at working in a team?	55%

	Has anything ever irritated you about the people you've worked with?	72%
	Is there anyone you just could not work with?	68%
Emotional Stability	If your previous co-workers were here, what would they say about you?	70%
	What are the things your former manager would like you to improve on?	74%
	Tell me about a time you made a mistake?	56%

EVALUATION

The evaluation of the results was conducted in two steps.

Human Rater Marking

Five human evaluators have participated for the rating purpose. Three of them were from IT industry with prior experience as interviewers at the work environment. The remaining human raters were specialized experts in the areas of Human Resource Management and Image Recognition. All the video clips were cropped to extract the question and answer for the above mentioned selected set of questions. The video clips were provided to the human raters to rate the candidate responses against each trait. The raters were instructed to mark considering the level of trait showcased while answering the interview questions. Human raters were provided with instruction sheets prior to marking in order to educate about the procedure of the research sufficiently.

They were instructed to provide the rating value varying in the range of 1-5 for each response adhering to the condition that "*The extent the question and response in total helped me to take the hiring decision*". To minimize the subjectivity in deciding the level of personality characteristics exhibited during the interview of the candidate, the average value of all five human raters was calculated. Based on the human ratings, it was expected to have a high emotional engagement in five questions and moderate engagement level in five questions as given in the Table 4.

Table 4: Human Rater Ranks received by each question

<i>Personality Trait</i>	<i>Questions</i>	<i>Human rater ranking</i>
Passion	Tell me a small description about yourself?	5
	What motivates you to do a good job?	4
	Tell me about an accomplishment you are most proud of?	3
Confidence	Explain why I should hire you?	4
	What can you offer us that someone else can not?	2
	Let's talk about salary, what are you looking for?	1
Cooperation	Are you good at working in a team?	3
	Has anything ever irritated you about the people you've worked with?	3.5
	Is there anyone you just could not work with?	3
Emotional Stability	If your previous co-workers were here, what would they say about you?	3
	What are the things your former manager would like you to improve on?	4
	Tell me about a time you made a mistake?	3

Cross Reference Analysis

The analyzed data sets of emotional engagement were cross checked against the rankings given by the human raters regarding the extent the question and response in total helped them to take the hiring decision. A summary of the cross reference analysis can be seen in the Table 5.

Table 5: Cross Reference Analysis

Personality Trait	Questions resulted in making a hiring decision	High emotional engagement value incurred questions	Human rater ranking	Emotional engagement % value
Passion	Short self-presentation	-	5	30%
<i>Passion</i>	<i>What motivates you to do a good job?</i>	<i>What motivates you to do a good job?</i>	4	60%
<i>Confidence</i>	<i>Explain why I should hire you?</i>	<i>Explain why I should hire you?</i>	4	70%
<i>Cooperation</i>	<i>Has anything ever irritated you about people you've worked with?</i>	<i>Has anything ever irritated you about people you've worked with?</i>	3.5	72%
<i>Emotional Stability</i>	<i>What are the things your former manager would like you to improve on?</i>	<i>What are the things your former manager would like you to improve on?</i>	4	74%
Emotional Stability	-	If your previous co-workers were here, what would they say about you?	3	70%

DISCUSSION

Organizations have the ability to reengineer their current interview process by analyzing the emotional variations of the interview questions. As future demands any profession with high level of soft skills and stakeholder management skills, it is evident that choosing emotionally stable candidates would play a vital role in organization's success. Hence, our research method would assist them to identify the set of questions that can affect the recruitment decision of the company. Technical tools that monitor emotional engagement can be used when preparing the interview question sets for an organization. As future work, through machine learning techniques researchers could use these findings as the base and work on emotional values extracted from the data sheets to analyse and design a model on the relationship between the facial cues and the personality traits of a person, which could be used to enhance the hiring decisions further.

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