Interconnection Between Human's Psychological Elements and Their Influential Mediums and Channels Are Potential Accelerators to Comprehend People's Inclination Towards Autonomous Vehicles

Aishwary Pramodrao Nipane and Anjali Awasthi

June 9, 2021

INTERCONNECTION BETWEEN HUMAN'S PSYCHOLOGICAL ELEMENTS AND THEIR INFLUENTIAL MEDIUMS AND CHANNELS ARE POTENTIAL ACCELERATORS TO COMPREHEND PEOPLE'S INCLINATION TOWARDS AUTONOMOUS VEHICLES

1. Mr. Aishwary Pramodrao Nipane 2. Dr. Anjali Awasthi

1. Master's Student, MASc.Information System Security
2. Professor and Concordia University Research Chair (II) Concordia University, Canada

ABSTRACT

Many of today's autonomous vehicle (AVs) improvements involve overcoming technology barriers to AV readiness. However, once AVs are out acceptance and people's willingness (APW) to use remain a concern. As a result, the question arises. Are we attentive enough towards humans' aspects in the evolution of AV technology? Do we need to? As a response, we seek to find an explanation through the study of human psychological aspects. In the study, we seek to streamline interdependency between psychological elements and how people receive the information through various mediums and channels, influencing their decision-making related to AVs. The study resulted in a theoretical comparative estimation table (CET) and CET Hierarchical Concept Map through the literature we reviewed. We believe the study provides vision and puts psychological elements into consideration of tackling challenges of APW of AVs and fosters interested researchers in forming AVs' survey questionnaires to comprehend better its APW with corresponding attributes used in the CET table and CET Hierarchical Concept Map.

Index Terms— Psychology, Willingness, Acceptance, Human Aspects, Autonomous Vehicles

1. INTRODUCTION

Self-driving cars or so-called Autonomous vehicles offer a great deal of excitement and zeal to technological evolution. The concept itself is so full of excitement where self-driving vehicles can perceive the surrounded environment and navigation within a defined range without human intervention. To understand the concept and make a vision into reality, one must understand the involvement of multiple heterogeneous technologies and their collaboration, but proper functioning is critical. The authors Kichun Jo et al [1] refer to autonomous cars as integrating two industries: the automotive and mobile robots. Dealing with the embodiment of multiple and heterogeneous technologies also leads to multiple problems and challenges from various fields, not only technical but also from nontechnical fields. It is clearly stated by Azim Shariff et al [2] that Many of

them are speeding past persisting technical challenges to AVs readiness. Nevertheless, one of the most important or, if not the most significant, challenge is adopting Autonomous vehicles (AVs) and willingness to use technology and acceptance, which associate with psychological aspects and mediums or channels through which people receive the information affect the individuals.

Psychology is an extraordinarily complex field. It has many variations and branches that are so overwhelming for an individual compared to technical fields. Thus, even though there has been astronomical research on psychology; we believe it is tough to get binary answers for the problems and challenges that exist within the field of research Furthermore, a similar experience we have observed in our study of literature review. Enough research discusses and correlates the psychological challenges and problems related to the acceptance, willingness to use, and AVs adoption; Azim Shariff et al [2], Peng Liu et al[3], John D Lee and Kristin Kolodge [4], Peng Liu [5] et al, Tripat Gill [6], Zhigang Xu et al[7], Huiying Du et al[8], and Christoph Hohenberger et al[9] are some of them we studied. Studies touch on psychological aspects ranging from Morality, fear, people's desire and willingness, trust, responses, and reactions to anxiety, opinions, Ethical and Social Dilemmas. These terminologies used were vague, but a significant observation we noticed is the interconnection between them. Jane So et al [10] connect psychology, emotions and decision making, while Markus Maurer et al [11] and Eva Fraedrich and Barbara Lenz [12] connect acceptance, willingness, and adoption with psychological aspects and decision making. Besides, we also noticed that how people receive the information through various mediums or channels significantly influences psychological aspects Huiying Du et al [8].

In this paper, we seek to streamline the compounded psychological terminologies. Throughout our study of literature reviews and multiple online articles (published and independent) that we studied, we came across more than 20+ terminologies [pool concept map]. However, for this paper, we have selected eight terminologies from different branches of psychology 1. Emotion 2. Social 3. Cognitive and Biological. We believe that these eight terminologies are fundamental to individuals' reaction, response, opinion

and Perception or point of view [RROP] towards how people show their willingness and acceptance towards certain things accompanying mediums or channels through which people receive information and once received information go through psychological processing. In closing, we seek to streamline our extracted data to understand the flow of information and create CET Hierarchical Concept Map. Furthermore, propose Theoretical Comparative Estimation Table (CET) with little motivation from work presented by Ankur Joshi et al [13] and Joseph Bonneau et al [14] with the thought of generating binary standpoints.

2. LITERATURE REVIEW

According to author Apurva S [15], psychology is the science of human behavior that includes specific behavior that applies to anything an individual does. There are multiple expressions in which humans behave, but two important and primary ways are covert and overt. Covert human behavior is when a person or an individual express inside. In contrast to it is Overt behavior which an individual express outside. For example, individuals express themselves with symbolic adoption called covert behavior and user acceptance as an example of overt behavior expressions. For our study, we have divided psychological factors as Emotion Psychology, Social Psychology, Cognitive Psychology and Biological Psychology. Under these terminologies, we have studied them further.

2.1. Emotions

According to an article written by Apurva S [15], emotions signify a state of being. It involves impulses. It also stirred up feelings, physical and as well as psychological reactions. Every individual is different in dealing with emotions. People usually make logical decisions, but if emotions are unstable or the intensity of emotions is high, people sometimes make decisions based on emotions that we cannot deny. We understand emotions categories into two-part positive emotions and negative emotions. A negative response may commence nonparticipation, non-interest, and non-cooperation. On the contrary, positive emotions may have opposite reactions to adverse reactions. Positive emotions may inject a sense of hope or positive thoughts. Joseph R Royce [16] suggested some rules for emotional control. For example, avoid emotion-provoking situations, Change the emotion-provoking situation to control emotions. Nevertheless, it takes a lot of discipline and emotional control to do it.

2.1.1. Fear

Fear is an emotion. Many studies on crises fail to point out fear or anxiety at all. Jack C Carlsen and Janne J Liburd[17], Bill Faulkner [18], Yoel Mansfeld [19] and Brent W

Ritchie [20] studies talked about these terms quite briefly without much clarification and used the terminology interchangeably by Laurence Barton [21], Michael Hitchcock and I Nyoman Darma Putra [22] and Sevil F Sonmez et al [23]. For example, Paul T Kingsbury and Stanley D Brunn [24] make no distinction between anxiety, risk, safety, and Fear Andrew Paul Lepp [25]. Fear considers as integral to the characteristic by Sara Dolnicar [26], Moreover, a distinctly underdeveloped topic says John R Gold and George Revill [27]. Fear is a primal emotion communicated by all living creatures John R Gold and George Revill [27], and it has adaptive value, and that is the reason which allows us to avoid dangerous situations Ingunn Skre et al[28]. Fear also considers a defensive response to avoid current threats by Josh M Cisler et al [29] and Joseph R Royce[16]. Seymour Epstein [30], David H Barlow[31], Patrick Sylvers et al [32] showed fear is an aversive emotional state which motivates people to avoid a particular and an imminent threat, and Steven Reiss [33] talks about three fundamentals of fears: Fear of injury, fear of anxiety, and Fear of negative evaluations. Ingunn Skre et al [28] divide fear into various types; one example is fear of vehicles. People recognize fear when they see it or experience it, says David A Fennell [34]. Danni Zheng et al[35], Kajsa E Dalrymple et al[36], Isaac Chun-Hai Fung et al [37], and Alex Lamb et al [38] relates an increase in fear as an entity directly proportional to the observation individual does by observing others' reactions and experiences. Adam Duhachek and Dawn Iacobucci [39] the study represented that fear triggers peoples' disengagement and emotion-seeking coping (self or social support) to escape and protect themselves. Josh M Cisler et al [29], Michael S LaTour and Herbert J Rotfeld [40], Clay Posey et al [41] studies also confirmed that fear could impact an individual's attitude and protective behaviors-toward the threat and lead people to realize the severity of the threat, increasing their self-protection motivation Liang Chen and Xiaodong Yang[42], Kim Witte et al [43].

2.1.2. Worry

Worry, David A Fennell [34] observes it as more a cognitive act than an emotional one but recognizing that both are difficult to separate. Worry identifies as the individual's attempt to engage in mental problem-solving issues where outcomes are thought to be uncertain and contain possibilities for unfavorable results Svein Larsen et al[44]; also distinguish worry from risk perception. Worry, nervousness, and apprehension view as synonymous with anxiety Sandro Carnicelli-Filho et al[45]. Because of this reason, we have considered the term worry as emotion and separated the term Worry from Risk. As explained in this paragraph, two terminologies are miles apart if we use them properly.

2.1.3. Anxiety

We Keep anxiety separate because the term usually utilizes it compared to worry, but as we could view in the previous section about worry, anxiety is slightly different from worry. Other terminologies associated with anxiety are nervousness, which is also part of fear, but here we have chosen anxiety, mainly because the anxiety is unavoidable, states Lorraine Brown [46]. Gloria Ingram [47] writes that individuals are often anxious over safety and property issues. Since our paper inclines towards acceptance and AVs' willingness, anxiety makes more sense because it closely relates to safety issues, which is essential in AVs issues.

2.1.4. Risk

Risk and perception of risk apply to many aspects. Sara Dolnicar[26] mentioned risk as a proxy for fear, so it just elaborates the link between fear and risk. Wesley S Roehl and Daniel R Fesenmaier [48] divide risk into seven categories as Equipment risk (breakdown), financial risk (value for money), physical risk (injury or sickness), psychological risk (vacation does not reflect the tourist's self-image or personality), satisfaction risk (vacation is not personally satisfying), and social risk (vacation will affect others' opinion of tourists). Jehn-Yih Wong and Ching Yeh [49] mentioned risk perception influences hesitation, which further influences the decision making, but knowledge can be crucial to moderation that relationship. As our paper focuses on the AVs.' point of view, we highlight physical, psychological, equipment, but chiefly satisfaction and hesitation as a primary focus because we understand these terminologies are closely related to AVs' risk.

2.1.5. Trust

Several definitions of trust between humans and machines have been proposed in many psychological studies, but what we include in our paper is the definition we understand close to our objectives. A few of them are as observes. According to Morton Deutsch (50)," the confidence that one will find what is desired from another, rather than what is feared." John K Rempel and John G Holmes [51] and JG Holmes and JK Rempel [52] represent trust as" the degree of confidence you feel when you think about a relationship." However, trust is a multidimensional construct. The authors mentioned above suggest that machine responsibility will become more critical in human-machine relationships to the extent that we choose to delegate autonomy and authority to" intelligent," but prosthetic, machines. The more power they are given, the greater the need for them to effectively communicate the intent of their actions so that the people who use them can have an appropriate expectation of their responsibility and interact with them effectively. The authors presented trust as an expectation based on an expectation basis at different levels of experience, including predictability, dependability or reliability, and faith. The growth of trust will depend on the human's ability to estimate the machine's behaviors' predictability. Finally, since human's trust is based upon observations of machine behavior, behaviors must be observable for trust to grow. If a machine or function is distrusted, the user will, if possible, prefers to do the task or tasks by himself, which leave little or no opportunity for him to re-evaluate his distrust because the machine (or function) has been removed from the system and is not delivering the behavioral evidence needed to hold a re-evaluation.

2.1.5. Anticipation

Robert Plutchik [53] inferred that there are eight raw emotions: anger, fear, sadness, disgust, surprise, anticipation, trust, and joy. According to Apurva S [15], wishes are patterns. Patterns involve anticipated future satisfaction. We understand that future anticipation may play a significant role in a person's behavior pattern or decision to act. The article also suggests that future anticipation is based on a subjective judgment, which might be irrational and faulty. Anticipation is a complex emotion that involves pleasure and anxiety while thinking or waiting for an anticipated event. Anticipation view in two completely different ways Shiwani Gurwara [54]. Most evidently, the direction in which anticipation moves is dependent on what we expect to happen in the near future. It involves hope when pleasant things are expected and anxiety when negative ones otherwise. Even though there is no prominent jury on how we perceive anticipation, the manifestations of anticipation are best explained by the feeling we may have experienced before getting on to a stage to give a presentation or talk. We understand that people who enjoy positive anticipation do not feel the need to share those with others. On the contrary, negative anticipation have them on edge and most people share those to seek comfort, which affects the people talking to about adverse incidences more, and it helps to spread negative instances faster than positive ones. Past experiences shape future expectations. Those with unpleasant past experiences are expected to have a higher level of negative anticipation. Anticipation is an intrinsic property of the mental reflection process of events, activity orientation, and behavior, says Anna I Akhmetzyanova [55]. Anticipation is spatial-temporary advancing and the degree of completeness and accuracy of prediction, state Boris F Lomov and EN Surkov[56]. As the authors specify, the concept of anticipation as an integral property of mentality carries out three essential functions in the world's reflection: communication, the interaction between people, and readiness to obey social norms. BG Ananyev [57], [58] emphasized the variety of anticipatory mechanisms. It is anticipation that provides the formation and programming of

behavior and activity; it joins the processes of decision-making, current control, and communicative acts.

2.2. Judgement specifically pre-judgment

In Cognitive Psychology, Judgement is one aspect of human behavior based upon the ability to make decisions or come to a sensible conclusion. Typically, judgement should consist of sensible conclusions based on examinations, consideration of facts. However, according to Apurva S [15], pre-judge is also based on certain assumptions—for example, innovation. Even though the judgment is very calculative and considerable, on the other hand, judgment before due examination and reflection of facts based on certain assumptions generally drive the development of pre-judge. It might be possible that pre-judge drives a hostile attitude towards the object. Pre-judge is usually challenging to alter, and influential factors involve personal contact, mass media use, and economic developments in more comprehensive preservation.

2.3. Awareness

There are many debates on the meaning of awareness as it constitutes many aspects of consciousness and perceptions. According to the yogapedia [59], the science of biological psychology defines Awareness is perception and cognitive response to a situation or circumstance. As described by Thomas Natsoulas[60], awareness is "the quality or state of being aware, consciousness and someone being "informed, cognizant, conscious, sensible." Moreover, it is related to the state of simply knowing something and to occurrent awareness. According to Sen [61], awareness is an ability to observe without needing thoughts, judgments, interpretations. However, it is easy-going to let in disapproval when an individual with low awareness refers to "Negative Awareness as Low Awareness" by the author. By the study conducted by John M Flach [62] and SimplySurvival [63], the author enlightens us that situation awareness refers to Situation awareness as the adaptive relation between an actor and an environment. The author mentioned that knowledge about the work domain or work environment, specifically complex environment influences professional situational awareness. Failing to address, it constructs a cause for tension results to achieve experimental control. The construct of situation awareness demands congruent between the subjective interpretation of an event and objective measures of the actual event. The substantial equivalence between the interpretation and the objective situation means high situation awareness. Weak correspondence means low situation awareness. The authors also believe that designing effective human-machine systems will set the agenda that basic research in human performance and cognition will need to follow with situation awareness. Based on our understanding, awareness related to acceptance can be divided into two categories: awareness

of people about the vehicle knowledge about the vehicle's situation responses to the unpredictable circumstances, which could be divided partially aware and not aware, fully aware. The author highlighted that awareness must serve the best wit, a proper mindset which starts with honesty and admitting the vital truth and trying everything to resolve it beforehand. Biased opinions about only positives or only negatively affects situational awareness.

2.4. Attitude

According to Gordon W Allport[64], attitude defined as "a mental state of readiness, organized through experience, exerting a directive and dynamic influence upon the individual's response to all objects and situations with which it relates, and Attitude's form about objects, persons and values". The author considered attitude as the most distinctive and indispensable concept in social psychology. The author stated that attitude gives direction to one's behavior and actions. Attitudes can have directions that fall under either favorable or positive and unfavorable or negative, says Apurva S [15]. We understand these directions play a significant role in terms of persons' nature to view things and their ability to understand the perspective about it. Attitude provides insight into people's behavior and their background, which leads to overt behaviors. Changes in attitude are generally not easily achievable by individuals unless intentionally subjected to the training and methods. It requires much discipline to change it. According to the Deeksha S [65], Some behaviouristically inclined social psychologists refer to the attitudes as conforming behavior. Once formed, they pressure the individual to react in a specific or characteristics way. RALPH L Rosnow and EDWARD J Robinson [66] view the term attitude; denotes the organization in an individual of his feelings, beliefs, and predispositions to behave. The article also mentioned that attitude contributes towards the selectiveness of a person. The author also stated that attitude could never be neutral. It can be positive or negative, favorable or unfavorable.

2.6. External Medium and Channels

Danni Zheng et a [35] explained in their empirical study about the travelers' trust and accept self-driving vehicles with the help factors affecting AVs as media effect, affecting self-efficacy and subjective norms. Moreover, they ultimately lead to people's trust and behavior change. The authors also mentioned that positive and negative reports (we so-called mediums and channels) greatly influence peoples' trust as well; the author also highlights in their theoretical foundation study that peers influence is one of the reasons behind changing of social norms, and so do the people's surroundings and then their response and reactions Colin Finkle [67]. Eva Fraedrich and Barbara Lenz [12] and Sharon L Poczter and Luka M Jankovic [68] study significantly stated that respondents and individuals obtain

information related to AVs or related topics primarily from Mass Media. Emily C Anania et al [69] believes that positive information may convince consumers to use them. Hillary Abraham et al [70] and Huiying Du et al [8] highlighted that the public's intention to purchase and accept AVs or self-driving cars is not high. Brandon Schoettle and Michael Sivak [71] also mentioned that public acceptance of AVs is inversely proportional to the automation level. From all the references and literature reviews we studied, we have selected a couple of points or categories that influence people's psychology more in general concerning how people receive the information through various channels and mediums have a significant influence on people's psychology and further on their reaction, response, opinions, and point of view [RROP]. Mediums and channels are the tools through which people receive information from various sources available to them. We present and categories them as shown in Fig 2. Categorization is as 1. Social 2. Mass Communication. Under the social category, we divided it into three sub-categories Peer influence (Wikipedia [72], Experience (sub-points 1. In Close Proximity 2. Personal or Past) and Bandwagon Affect. Under Mass Communication, we divided them into three categories 1. Mass Media (Mass media - Wikipedia [73]) 2. Alternate Media (Alternative media -Wikipedia [74]) 3. Social Media. In extension to that, we add two sub-categories Mass Media and publications and independent sources as Alternate Media and social media, as we understand, could make a significant difference (What is the Alternative Media -Wikipedia (69)). One last terminology that we selected for the paper that we observed could influence the people's reaction, and a response is what we called " Bandwagon Affect," whereas explained in the article by Colin Finkle [70], people usually influenced by their peers, specifically from a peer group. For Example, as a future hypothetical scenario, if an individual is living among the group of people who bought the AVs, an individual automatically reacts and responds positively about the product. In such a scenario we believe, an individual's opinions Furthermore, point of view significantly could affect a person's choice.

2.6. Reactions, Response, Opinion and Point of view / Perception [RROP]

In the article React vs Respond, Matt James [75] stats, reaction states as an instant driven by beliefs, biases, and prejudices of the unconscious mind. When we react means an individual unconscious mind is running. One example where the author described the reaction is based on fear or embarrassment, or guilt. Though reaction and response are used synonymously, they are different from what we understood from the previous reference. The inclusion of terminologies such as Opinion, Perception or Point of View is like what we observed for response and reaction. As per www.merriam-webster.com definition, it is clear that opinion is the view, judgment about a particular subject. The opinion is usually considered a formal expression and could be the final catalyst in decision-making. On the other hand, according to Google's definition and Perspective vs Point of View Examples Kristy Littlehale [76] and Point of View: Definitions and Examples in literaryterms [77], perspective comes up through awareness and attitude towards something described point of view. However, for our study, even though they are notably different from each other, one common point on which we clubbed them together is because both come from someone's narration. So, we decided to put them into the same bracket as our study. It focuses on the individual itself and his or her decision-making and factors that influence it.

3. METHODOLOGY

It was thought desirable to follow mixed methods to examine literature selectively to keep our focus on study objectives dominantly with the use of secondary data.

3.1. Method

At the start, we performed Literature searches using "Google Scholar" with specific keywords closed to our objectives. To perform a literature review, we first go through available searchers with keywords such as Acceptance, attitude, Autonomous vehicles, challenges of AVs, human problems with their interconnected terminologies on google scholar. It was followed by further resources available on the internet based on the points we observed, which were inclined towards our objectives inside reviewed references to extend our search. After the literature reviewed, we Synthesize the theoretical comparative estimation table (CET); elements interpreted from the literature review integrated into the CET table with consideration of generating binary standpoints and CET hierarchical concept Map.

3.1.1. Pool Concept Map [Figure 1]

The diagram [fig 1] shows a large pool of research knowledge we reviewed and came across and touches on psychological aspects consists of 20+ terminologies ranging from Morality, fear, people's desire and willingness, trust, responses, and reactions to anxiety, opinions, Ethical and Social Dilemma as shown in Pool Concept Map as we called it. So, we understand the need to streamline 20+ compounded terminologies with eight selective terminologies, which our study shows ahead in creating a theoretical CET Concept map and table.

3.1.2. Selection Criteria for Psychological aspects and (Influential) Mediums and Channels

Below represents our selective criteria of psychological aspects and mediums or channels we use to create and proposed the CET table and CET Hierarchical concept map of Data flow from the literature review we reviewed.

Psychological aspects

1. Signify a state of being.
2. Universally communicated by all high intellectual living creatures.
3. Unavoidable
4. Stirred up psychological reaction, response, opinion and Perception or point of view [RROP] aspects.
5. based on intensity
6. Adverse aspects may commence nonparticipation and non-interest of an individual.
7. Not easy for an individual to control them and needs a lot of discipline and emotional control.

(Influential) Mediums and Channels

1. Types of resources from where people receive the information.
2. How people receive information through either from context interpretation, visually, surroundings or within proximity

3.2. Contribution

3.2.1. CET Hierarchical Concept Map [Fig 2]

It represents the extraction of the CET Hierarchical concept map from the literature we reviewed after streamlining the psychological aspects and their influential mediums or channels. Arrow represents the flow of information from down to up as How people receive information through either context interpretation, visually, surroundings or within close proximity and Types of resources from where people receive the information.

It represents our extracted reflections on content analysis of literature we performed with Hawking Publication Timeline template concept map of the Free Edraw Mindmaster software version. The reason to choose the timeline template is to convey our understanding of the flow process of human behavior, and their thinking works down to up. From the bottom, people first receive the information, then processing it within, influencing their RROP. We understand once established after the complete cycle of information gathering through mentioned channels or mediums and influential factors administered by an individual and making their decision reflecting on their willingness and acceptance of AVs.

3.2.1. Theoretical Comparative Estimation Table (CET) [Fig 3A and 3B]

To develop the theoretical model table for this study, we reviewed the secondary data content from literature to extract or create both CET Hierarchical Concept map and CET Table with secondary data considering research objectives in an integrated way such that new perspectives are generated. This table has selected eight psychological aspects that we feel are simpler and more universal to identify 20+ compounded terminologies based on our selection criteria of literature content analysis and reasons author Apurva S [15] stated to generate binary standpoints. We understood that there is no proper meter to measure psychological terminologies as we do for weights through our literature review study after considering principally two scaling approaches by Ankur Joshi et al [13] and Joseph Bonneau et al [14]. Nonetheless, we settled on a solution towards placing the terminologies and extracted data in a tabular arrangement, as shown in figure 3A and 3B, to provide close to binary answers.

4. DISCUSSION

In this paper, we seek to analyze the psychological aspects behind willingness, acceptance of people. After understanding the complicated terminologies, we observed in the literature reviews, we streamlined and elected eight elements that could potentially affect and influence human behavior. We understand some aspects which could potentially serve as catalysts, such as mediums or channels through which generally people receive and gather the information. After our observation and interpretation, we proposed the CET Hierarchical map and the CET table and believe they will be valuable as a prerequisite for future study related to APW of AVs explicitly related to psychological aspects and the effects of medium and channels on human behavior once an individual receives information. The CET table we proposed would be helpful with the extension of Ankur Josh et al [13] and Joseph Bonneau et al [14] or any other scaling approaches to facilitate quantitative and statistical data results, which is our future extent of the study. CET Table- Part 2 can also help categorize elements. Alternatively, mediums or channels if we choose them as columns. We could also choose a whole table or any references for selection to evaluate parameters. We believe that our study provides insights to interested manufacturers and fellow researchers to tackle APW challenges and fosters interested researchers in forming AVs' survey questionnaires to comprehend better its acceptance, people's willingness (APW). Secondly, it connects human perception and autonomous technologies and even further any future technologies to target people's acceptance solutions. Thirdly, multiple companies nowadays spend much time marketing their products and their high-tech features but hardly focus on psychological

factors that require conveying to attract the customers and resolve their issues and doubts to increase their awareness about the doubts they have related to the product explicitly AVs to attract the customer with pace.

5. CURRENT AND FUTURE SCOPE

This study aims to provide insights into the interconnection between human psychological elements and how people receive information through influential channels or mediums. The scope of the study is limited to the literature we reviewed, the secondary data collection method with a purposeful random selection of literature based on study objectives with no time frame. The study's central focus on eight psychological elements focuses highly on the creation of the CET table. The study constraints to manual subjective content analysis. The scope of the study is relevant to all highly intelligent human species.

For the forthcoming study, we plan to target various references, primarily secondary published references like articles, news, journals, blogs, and others and seek to evaluate the efficiency of our CET table with our binary scaling approach to facilitate quantitative and statistical data results to support our study further. We seek to present statistical data results, which we will obtain and analyze the results. We seek insights into some of the ideas and parameters or details that might be missed or need improvement and update the CET table in the future if we observe that need to be added.

6. LIMITATION

The study is based on a subjective interpretation of the literature review. So, we attempt to target aspects that we believe could be generalized. We realize that each person is unique and possesses individuality, representing whole different scenarios and variations. Constraints over the precision of the CET table and CET hierarchical map depend on our subjective interpretation. They probably may not represent the true representative of populations due to subjective content analysis and contextual interpretation of psychological aspects. Due to fixed numbered literature reviewed, anything outside of literature limits the study with the magnitudes of fields. The references we studied solely focus on study objectives; therefore, the hypothesis is considered non-essential due to the nature of the study.

7. CONCLUSION

The study put streamlined interdependency between psychological elements and their influential channels through the literature we reviewed. The study streamlined how people receive the information through various mediums and channels, influencing their decision-making, especially related to autonomous vehicles (AVs). The study resulted in a theoretical comparative estimation table (CET)
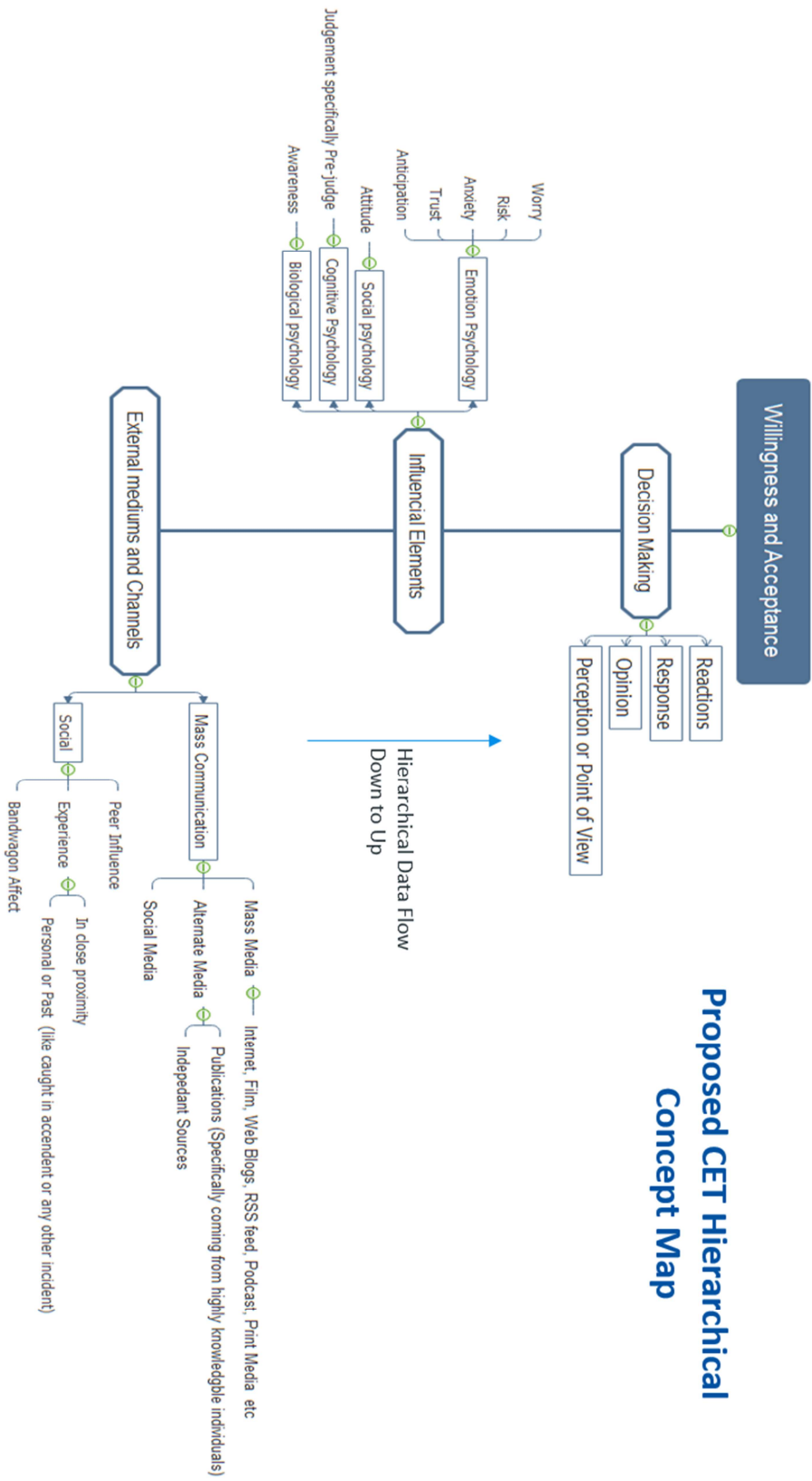
and CET Hierarchical Concept Map through a literature review to show the interconnection between the AVs. The creation of CET table provides vision and puts psychological elements into the consideration of tackling challenges of people's willingness and acceptance of AVs. The study provides insights to interested manufacturers and fellow researchers to tackle APW challenges AVs from Human Psychological elements and influential mediums or channels perspectives. Study fosters interested researchers in forming AVs' survey questionnaires to comprehend better its acceptance, people's willingness (APW) with corresponding attributes used in CET table and CET Hierarchical Concept Map.

8. ILLUSTRATION SECTION

8.1 Pool Concept Map [Fig 1]
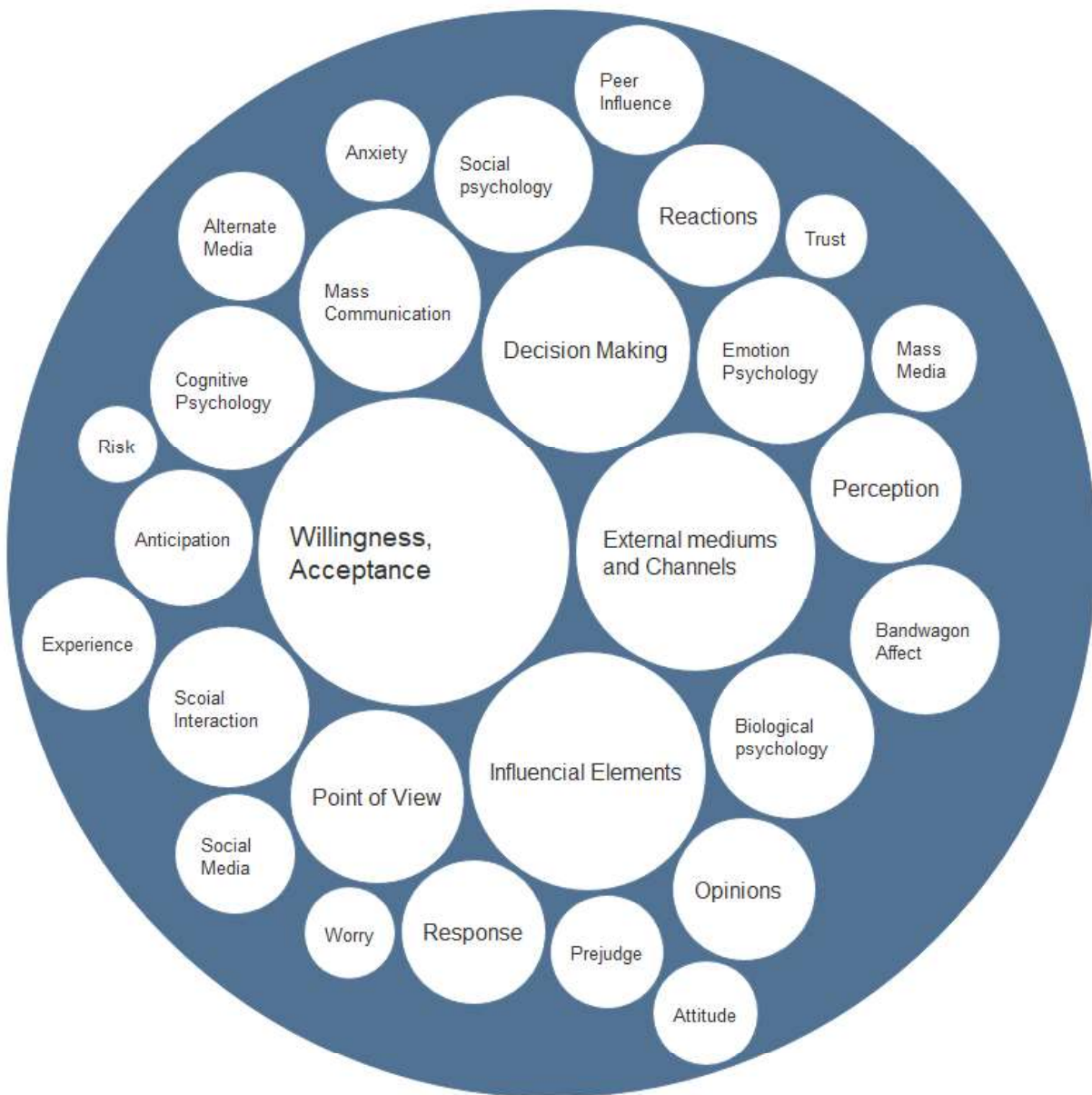
8.2 CET Hierarchical Concept Map [Fig 2]

Proposed CET Hierarchical Concept Map

8.3. THEORETICAL COMPARATIVE ESTIMATION (CET) Table [Fig 3A and Fig 3B]

Fig 3A – CET Table

References to Study	Psychology														
	Emotion										Social		Cognitive		Biological
	Fear														
	Worry		Risk		Anxiety		Trust		Anticipation		Attitude		*Prejudge*		*Awareness*
	Certain possibilities of negative results	Uncertain possibilities of negative results	Low	High	Minor	Severe	Trust	Distrust	Positive	Negative	Low Readiness	High Readiness	Low magnitude assumptions	High magnitude assumptions	*Low*	*High*

Fig 3B – CET Table

References to Study	Mediums or Channels						
	Mass Communication			Social Interaction			
						Bandwagon Affect	
	Mass Media	Alternate Media	Social Media	Peer Influence	Personal or Past Experiences	Trending	Non-Trending

8. REFERENCES

[1] Kichun Jo, Junsoo Kim, Dongchul Kim, Chulhoon Jang, and Myoungho Sunwoo, "Development of autonomous car—part i: Distributed system architecture and development process," IEEE Transactions on Industrial Electronics, vol. 61, no. 12, pp. 7131 7140, 2014.

[2] Azim Shariff, Jean-Franc¸ois Bonnefon, and Iyad Rahwan, "Psychological roadblocks to the adoption of selfdriving vehicles," Nature Human Behaviour, vol. 1, no. 10, pp. 694–696, 2017.

[3] Peng Liu, Qianru Guo, Fei Ren, Lin Wang, and Zhigang Xu, "Willingness to pay for self-driving vehicles: Influences of demographic and psychological factors," Transportation Research Part C: Emerging Technologies, vol. 100, pp. 306–317, 2019.

[4] John D Lee and Kristin Kolodge, "Exploring trust in self-driving vehicles through text analysis," Human factors, vol. 62, no. 2, pp. 260–277, 2020.

[5] Peng Liu, Yong Du, and Zhigang Xu, "Machines versus humans: People's biased responses to traffic accidents involving self-driving vehicles," Accident Analysis & Prevention, vol. 125, pp. 232–240, 2019.

[6] Tripat Gill, "Blame it on the self-driving car: how autonomous vehicles can alter consumer morality," Journal of Consumer Research, vol. 47, no. 2, pp. 272–291, 2020.

[7] Zhigang Xu, Kaifan Zhang, Haigen Min, Zhen Wang, Xiangmo Zhao, and Peng Liu, "What drives people to accept automated vehicles? findings from a field experiment," Transportation Research Part C: Emerging Technologies, vol. 95, pp. 320–334, 2018.

[8] Huiying Du, Ge Zhu, and Jiali Zheng, "Why travelers trust and accept self-driving cars: an empirical study," Travel behaviour and society, vol. 22, pp. 1–9, 2021.

[9] Christoph Hohenberger, Matthias Sp¨orrle, and IsabellM Welpe, "Not fearless, but self-enhanced: The effects of anxiety on the willingness to use autonomous cars depend on individual levels of self-enhancement," Technological Forecasting and Social Change, vol. 116, pp. 40–52, 2017.

[10] Jane So, Chethana Achar, DaHee Han, Nidhi Agrawal, Adam Duhachek, and Durairaj Maheswaran, "The psychology of appraisal: Specific emotions and decisionmaking," Journal of Consumer Psychology, vol. 25, no. 3, pp. 359–371, 2015.

[11] Markus Maurer, J Christian Gerdes, Barbara Lenz, and Hermann Winner, Autonomous driving: technical, legal and social aspects, Springer Nature, 2016.

[12] Eva Fraedrich and Barbara Lenz, "Societal and individual acceptance of autonomous driving," in Autonomous driving, pp. 621–640. Springer, 2016.

[13] Ankur Joshi, Saket Kale, Satish Chandel, and D Kumar Pal, "Likert scale: Explored and explained," Current Journal of Applied Science and Technology, pp. 396–403, 2015.

[14] Joseph Bonneau, Cormac Herley, Paul C Van Oorschot, and Frank Stajano, "The quest to replace passwords: A framework for comparative evaluation of web authentication schemes," in 2012 IEEE Symposium on Security and Privacy. IEEE, 2012, pp. 553 567.

[15] Apurva S, "11 main aspects of human behaviour — psychology," https://www.yourarticlelibrary.com/psychology/11-main-aspects-of-human-behaviour-psychology/89555.

[16] Joseph R Royce, "The nature of human intelligence. jp guilford. mcgraw-hill, new york, 1967. xiv+ 538 pp., illus. $14.75," 1968.

[17] Jack C Carlsen and Janne J Liburd, "Developing a research agenda for tourism crisis management, market recovery and communications," Journal of Travel & Tourism Marketing, vol. 23, no. 2-4, pp. 265–276, 2008.

[18] Bill Faulkner, "Towards a framework for tourism disaster management," Tourism management, vol. 22, no. 2, pp. 135–147, 2001.

[19] Yoel Mansfeld, "Cycles of war, terror, and peace: Determinants and management of crisis and recovery of the israeli tourism industry," Journal of Travel Research, vol. 38, no. 1, pp. 30–36, 1999.

[20] Brent W Ritchie, "Chaos, crises and disasters: a strategic approach to crisis management in the tourism industry," Tourism management, vol. 25, no. 6, pp. 669–683, 2004.

[21] Laurence Barton, "Crisis management: Preparing for and managing disasters," Cornell Hotel and Restaurant Administration Quarterly, vol. 35, no. 2, pp. 59–65, 1994.

[22] Michael Hitchcock and I Nyoman Darma Putra, "The bali bombings: Tourism crisis management and conflict avoidance," Current Issues in Tourism, vol. 8, no. 1, pp. 62–76, 2005.

[23] Sevil F S¨onmez, Yiorgos Apostolopoulos, and Peter Tarlow, "Tourism in crisis: Managing the effects of terrorism," Journal of travel research, vol. 38, no. 1, pp. 13–18, 1999.

[24] Paul T Kingsbury and Stanley D Brunn, "Freud, tourism, and terror: Traversing the fantasies of postseptember 11 travel magazines," Journal of Travel & Tourism Marketing, vol. 15, no. 2-3, pp. 39–61, 2004.

[25] Andrew Paul Lepp, Tourism in a rural Ugandan village: impacts, local meaning and implications for development, University of Florida, 2004.

[26] Sara Dolnicar, "Understanding barriers to leisure travel: Tourist fears as a marketing basis," Journal of Vacation Marketing, vol. 11, no. 3, pp. 197–208, 2005.

[27] John R Gold and George Revill, "Exploring landscapes of fear: marginality, spectacle and surveillance," Capital & Class, vol. 27, no. 2, pp. 27–50, 2003.

[28] Ingunn Skre, Sidsel Onstad, Svenn Torgersen, Sidsel Lygren, and Einar Kringlen, "The heritability of common phobic fear: a twin study of a clinical sample," Journal of Anxiety Disorders, vol. 14, no. 6, pp. 549– 562, 2000.

[29] Josh M Cisler, Bunmi O Olatunji, and Jeffrey M Lohr, "Disgust, fear, and the anxiety disorders: A critical review," Clinical psychology review, vol. 29, no. 1, pp. 34–46, 2009.

[30] Seymour Epstein, "The nature of anxiety with emphasis upon its relationship to expectancy," Anxiety; Current trends in theory and research, pp. 291–337, 1972. [31] David H Barlow, Anxiety and its disorders: The nature and treatment of anxiety and panic, Guilford press, 2004.

[32] Patrick Sylvers, Scott O Lilienfeld, and Jamie L LaPrairie, "Differences between trait fear and trait anxiety: Implications for psychopathology," Clinical psychology review, vol. 31, no. 1, pp. 122–137, 2011.

[33] Steven Reiss, "Expectancy model of fear, anxiety, and panic," Clinical psychology review, vol. 11, no. 2, pp. 141–153, 1991.

[34] David A Fennell, "Towards a model of travel fear," Annals of Tourism Research, vol. 66, pp. 140–150, 2017.

[35] Danni Zheng, Qiuju Luo, and Brent W Ritchie, "Afraid to travel after covid-19? self-protection, coping and resilience against pandemic 'travel fear'," Tourism Management, vol. 83, pp. 104261, 2021.

[36] Kajsa E Dalrymple, Rachel Young, and Melissa Tully, ""facts, not fear" negotiating uncertainty on social media during the 2014 ebola crisis," Science Communication, vol. 38, no. 4, pp. 442–467, 2016.

[37] Isaac Chun-Hai Fung, Zion Tsz Ho Tse, Chi-Ngai Cheung, Adriana S Miu, and King-Wa Fu, "Ebola and the social media.," 2014.

[38] Alex Lamb, Michael Paul, and Mark Dredze, "Separating fact from fear: Tracking flu infections on twitter," in Proceedings of the 2013 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, 2013, pp. 789–795.

[39] Adam Duhachek and Dawn Iacobucci, "Consumer personality and coping: Testing rival theories of process," Journal of Consumer Psychology, vol. 15, no. 1, pp. 52– 63, 2005.

[40] Michael S LaTour and Herbert J Rotfeld, "There are threats and (maybe) fear-caused arousal: Theory and confusions of appeals to fear and fear arousal itself," Journal of advertising, vol. 26, no. 3, pp. 45–59, 1997.

[41] Clay Posey, Tom L Roberts, and Paul Benjamin Lowry, "The impact of organizational commitment on insiders' motivation to protect organizational information assets," Journal of Management Information Systems, vol. 32, no. 4, pp. 179–214, 2015.

[42] Liang Chen and Xiaodong Yang, "Using eppm to evaluate the effectiveness of fear appeal messages across different media outlets to increase the intention of breast self-examination among chinese women," Health communication, 2018.

[43] Kim Witte, Judy M Berkowitz, Kenzie A Cameron, and Janet K McKeon, "Preventing the spread of genital warts: Using fear appeals to promote self-protective behaviors," Health Education & Behavior, vol. 25, no. 5, pp. 571–585, 1998.

[44] Svein Larsen, Wibecke Brun, and Torvald Øgaard, "What tourists worry about–construction of a scale measuring tourist worries," Tourism Management, vol. 30, no. 2, pp. 260–265, 2009.

[45] Sandro Carnicelli-Filho, Gisele Maria Schwartz, and Alexander Klein Tahara, "Fear and adventure tourism in brazil," Tourism management, vol. 31, no. 6, pp. 953– 956, 2010.

[46] Lorraine Brown, "Tourism: A catalyst for existential authenticity," Annals of Tourism Research, vol. 40, pp. 176–190, 2013.

[47] Gloria Ingram, "Motivations of farm tourism hosts and guests in the south west tapestry region, western australia: A phenomenological study," Indo-Pacific journal of phenomenology, vol. 2, no. 1, pp. 1–12, 2002.

[48] Wesley S Roehl and Daniel R Fesenmaier, "Risk perceptions and pleasure travel: An exploratory analysis," Journal of Travel research, vol. 30, no. 4, pp. 17–26, 1992.

[49] Jehn-Yih Wong and Ching Yeh, "Tourist hesitation in destination decision making," Annals of Tourism Research, vol. 36, no. 1, pp. 6–23, 2009.

[50] Morton Deutsch, The resolution of conflict: Constructive and destructive processes, Yale University Press, 1973.

[51] John K Rempel and John G Holmes, "How do i trust thee-trust is one of the most important and necessary aspects of any close relationship-by taking this trust test you can count the ways and understand the whys," Psychology today, vol. 20, no. 2, pp. 28, 1986.

[52] JG Holmes and JK Rempel, "Trust and conflict in close relationships," in Invited address at the 94th Annual Convention of the American Psychological Association, Washington, DC, 1986.

[53] Robert Plutchik, Emotions and life: Perspectives from psychology, biology, and evolution., American Psychological Association, 2003.

[54] shiwani gurwara, "Circle of emotions - anticipation," https://www.shiwanigurwara.com/2020/08/28/circle-ofemotions-anticipation/, Aug 28, 2020.

[55] Anna I Akhmetzyanova, "The theoretical analysis of the phenomenon of anticipation in psychology.," International Journal of Environmental and Science Education, vol. 11, no. 7, pp. 1559–1570, 2016.

[56] Boris F Lomov and EN Surkov, "On anticipation levels in activity structure (in russian)," Studia Psychologica, vol. 22, no. 1, pp. 29, 1980.

[57] BG Ananyev, "Problems of age psychology," M.: Direkt Media Publishing, 2008.

[58] BG Ananyev, "Personality, subject of activity, identity," Direct-media, Moscow, 2008.

[59] yogapedia, "Awareness," https://www.yogapedia.com/definition/7398/awareness : :text=The%20science%20of%20biological %20psychology%20defines%20awareness%20as,to %20become%20more%20aware%20of%20the%20inner %20Self., August 5, 2018.

[60] Thomas Natsoulas, "The concept of consciousness: The awareness meaning.," Journal for the Theory of Social Behaviour, 1992.

[61] Sen, "What is awareness?," https://www.calmdownmind.com/what-is-awareness/, February 8, 2012.

[62] JohnMFlach, "Situation awareness: In search of meaning," CSERIAC Gateway, vol. 6, no. 6, pp. 1, 1996.

[63] SimplySurvival, "Situational awareness — what is it (and why should you care)," https://www.simplysurvival.com/situationalawareness/, Jul 7, 2020.

[64] Gordon W Allport, "Attitudes: a handbook of social psychology," Worcester, vol. 2, 1935.

[65] Deeksha S, "Attitude: Meaning, concept and formation — psychology," https://www.psychologydiscussion.net/attitudes/attitudemeaning-concept-and-formation-psychology/1360.

[66] RALPH L Rosnow and EDWARD J Robinson, "Primacy-recency," Experiments in persuasion, p. 99, 1967.

[67] Colin Finkle, "Peer influence in marketing," https://brandmarketingblog.com/articles/brandingdefinitions/ peer influence/, November 5, 2018.

[68] Sharon L Poczter and Luka M Jankovic, "The google car: driving toward a better future?," Journal of Business Case Studies (JBCS), vol. 10, no. 1, pp. 7–14, 2014.

[69] Emily C Anania, Stephen Rice, Nathan W Walters, Matthew Pierce, Scott R Winter, and Mattie N Milner, "The effects of positive and negative information on consumers' willingness to ride in a driverless vehicle," Transport policy, vol. 72, pp. 218 224, 2018.

[70] Hillary Abraham, Chaiwoo Lee, Samantha Brady, Craig Fitzgerald, Bruce Mehler, Bryan Reimer, and Joseph F Coughlin, "Autonomous vehicles and alternatives to driving: trust, preferences, and effects of age," in Proceedings of the transportation research board 96th annual meeting (TRB'17), 2017.

[71] Brandon Schoettle and Michael Sivak, "Public opinion about self-driving vehicles in china, india, japan, the us, the uk, and australia," Tech. Rep., University of Michigan, Ann Arbor, Transportation Research Institute, 2014.

[72] Wikipedia, "Peer pressure," https://en.wikipedia.org/wiki/Crosscultural differencesindecision making:

[73] Wikipedia, "Alternative media - wikipedia," https://en.wikipedia.org/wiki/Massmedia:

[74] Wikipedia, "Alternative media - wikipedia," https://en.wikipedia.org/wiki/Alternativemedia:

[75] Matt James Ph.D., "React vs respond - what's the difference?," https://www.psychologytoday.com/us/blog/focusforgiveness/ 201609/react-vs-respond, Posted Sep 01, 2016.

[76] Kristy Littlehale, "Point of view vs perspective," https://www.storyboardthat.com/articles/e/pointof- view-vs perspective.

[77] literaryterms, "Point of view," https://literaryterms.net/point-of-view/.

[78] Carl I Cater, "Playing with risk? participant perceptions of risk and management implications in adventure tourism," Tourism management, vol. 27, no. 2, pp. 317–325, 2006.