AUTOMOTIVE MARKETING RESEARCH AND VIRTUAL REALITY: A REVIEW OF RECENT PATENTS

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Abstract: Virtual Reality (VR) is becoming a fast-growing technology and research has shown that may reduce development cost and improve timing to market for new vehicles. This study aims to characterize profiles of the technological prospection of virtual reality application in automotive marketing research. This study investigates the patenting activity to map out the technological progress in this area. On this basis, we found applications in recent decades, characterized by few inventors and with the United States presenting the largest number of records. We conclude that patent applications demonstrate the importance of the study subject and identified that most commonly patent application are related to apparatus able to automatic read participants reactions in a virtual environment.

Keywords: Virtual Reality; Marketing Research; Product Development; Automotive.

PESQUISA DE MERCADO AUTOMOTIVO E REALIDADE VIRTUAL: UMA REVISÃO DA PROSPECÇÃO TECNOLOGICA.

Resumo: A realidade virtual está se tornando uma tecnologia de rápido crescimento, e pesquisas mostram que a mesma pode reduzir o custo e tempo de lançamento de veículos. Este estudo tem como objetivo caracterizar perfis de prospecção tecnológica de aplicação da realidade virtual na pesquisa de mercado automotivo. O mesmo investiga a atividade de patenteamento para mapear o progresso tecnológico nessa área. Nesta base, encontramos publicações caracterizadas por poucos inventores e com os Estados Unidos com o maior número de registros. Concluímos que os mesmos demonstram a importância do objeto de estudo e identificamos que os registros tem como aplicação mais comuns aparelhos capazes de ler automaticamente as reações dos participantes em um ambiente virtual.

Palavras-chave: Realidade Virtual; Pesquisa de Mercado; Desenvolvimento de Produto; Automotivo.

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1. INTRODUCTION

Virtual Reality (VR) environment is defined as an environment where the participant is totally immersed in, and able to interact with a completely synthetic world that may mimics some real-world environment [1].

In the automotive sector, VR technology has been used by Original Equipment Manufacturer (OEM) in manufacturing analysis [2], assembly process, ergonomics studies, test drives and other applications [3]. As example, Ford has a VR lab at Michigan Development Center named Ford Immersive Vehicle Environment Lab (FIVE). FIVE is equipped with highly-sensitive motion detectors placed around the room, mapping movement of the VR goggle wearer in a virtual car, allowing designers to validate design intention in a virtual environment. During the pandemic COVID-19 lockdown, Ford designers collaborated on new vehicles in a virtual design studio. Using VR headsets, they worked alongside each other in a virtual world to review computer aided design-generated models of vehicles in development [4].

Beside all VR use in automotive business, there is still few applications of final automotive users in early product development phase identify in the literature. Several VR applications are identified in automotive business by Lawson, Salanitri and Waterfield (2016), but studies focused only in employees who are current potential OEM users of VR and not final customers [5]. Automotive industry showcases their products in virtual environment to customers [6], but not during product creation phase.

OEM conducts research with final customers to get input on opinion and costumer preferences as well as their intention for future purchase. These surveys, known as Car Clinics, provide in-depth feedback and insights from costumers to Marketing, Engineering and Design [7]. Car Clinics can be Dynamic, involving vehicle motion, or Static, involving stationary properties or test materials.

Static Car Clinics are performed in a showroom, where automakers show four to eight competing brand and models to consumers. Surveys can be quantitative, where large amounts of data through questionaries' are collected, or qualitative, where customer are motivated to provide impressions through close observation. Qualitative process is performed in a small group, also known as focus group, on a face to face encounter with a facilitator providing guidance on collect answer from participants based in survey objective

Respondents may have opportunity to experience vehicle exterior and interior design, performance and content comparison. Participants are selected through a specific profile defined by the research objective, normally relate to purchase intention.

In automotive business, vehicle size and stylish are the major factors on costumer product desire and decision of acquisition, so costumer perception of spatial product is fundamental. Based on that, surveys are performed with visual stimulus which are in majority static full-scale physical models.

Comparisons are based on production vehicles, and prototypes are used for vehicles in development. Special fabrication means construct such properties, requiring significant specialized workforce. That represent a considerable cost and timing of the automotive product development.

The automotive business has been pressed to improve its timing to market with assertive product definition. Use of VR in market research is an opportunity to reduce

cost and timing in automotive development. During clinics, VR application may prevent properties rework as well as the need of specialized resource on standby mode in case of properties damage.

This study aims to characterize profiles of the technological prospection of virtual reality application in automotive marketing research.

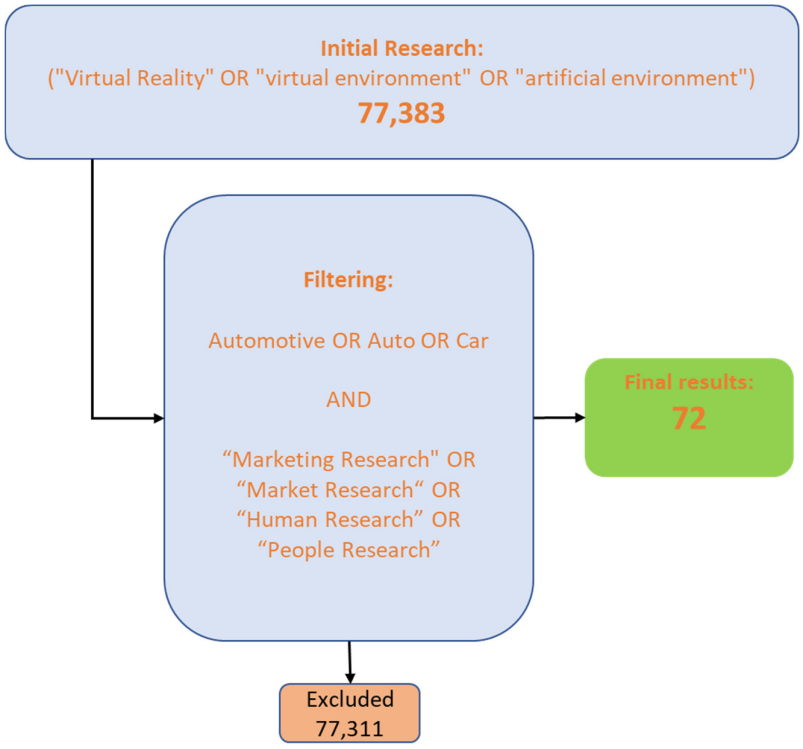
2. METHODOLOGY

This study is a patenting activity map out of the technological progress of VR application in automotive marketing research [8]. The PatentScout database was used to search for the patents documents [9]. The articles discussed throughout the text were found in searches using the following descriptors and keywords:

("virtual reality" OR "virtual environment" OR "artificial environment") AND (Automotive OR Auto OR Car) AND (“Marketing Research" OR “Market Research" OR “Human Research” OR “People Research”)

The selected keywords are highlighted in Fig 1.

Figure 1. Methodology Workflow.



Search was conducted in July 2020 and found 72 patents. The patents identified were exported to Microsoft Excel, where spreadsheets and figures were subsequently created for review them.

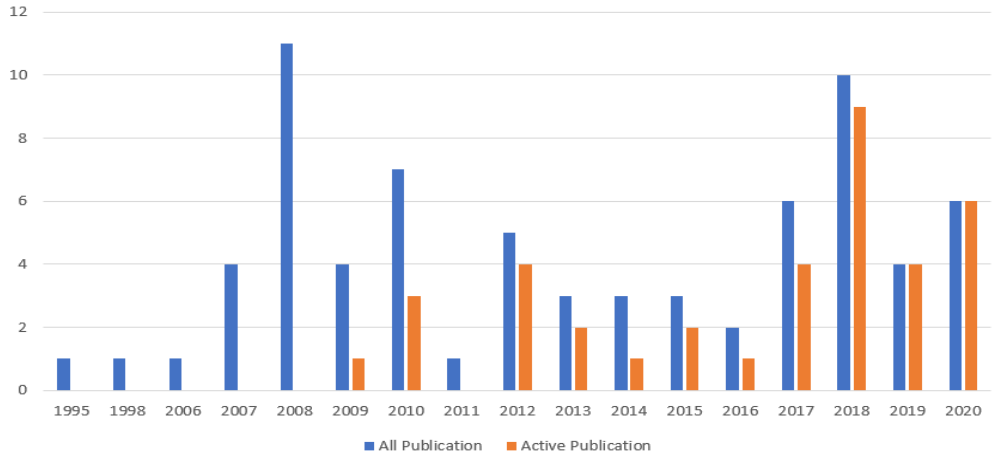
3. RESULTS AND DISCUSSION

The results analyzed patent publication number, title, abstract, active, assignee, inventors, priority date, publication date, file date, publication country source and first claim. From the seventh two patents, only third seven are active.

3.1 – Annual Application of Patents

Fig. 2 shows the filing of patent documents identified. The first registration patent granted by the World Intellectual Property Organization (WIPO) have the subject of a computer system allowing a consumer to purchase packaged goods at home.

Figure 2. Global publications of patent documents over years.



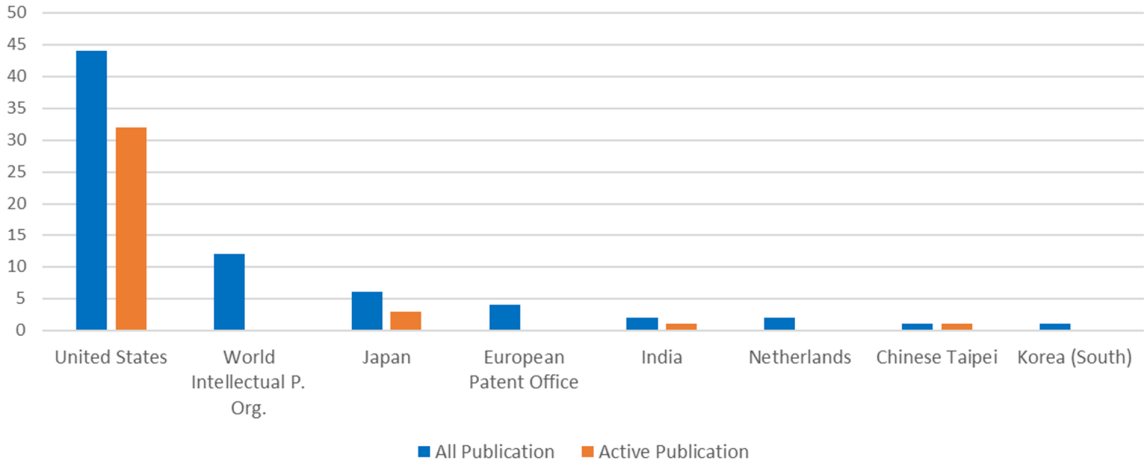
From 2019 to 2020 results express a slight decrease in the publications in relation to the year before, but that may be affected due to the 18 months patents confidentiality period.

Patents active are found from 2009 until 2020 and achieve the highest value in 2018 with nine documents.

3.2 – Source of Patents

Fig. 3 shows the country or organization of patent publication. Patents publications are not spread around the world. The study also identifies that there are only four players with patents active in the search provided: United States of America, Japan, Chinese Taipei and India. United States of America has a significantly higher number of patents active over the other countries.

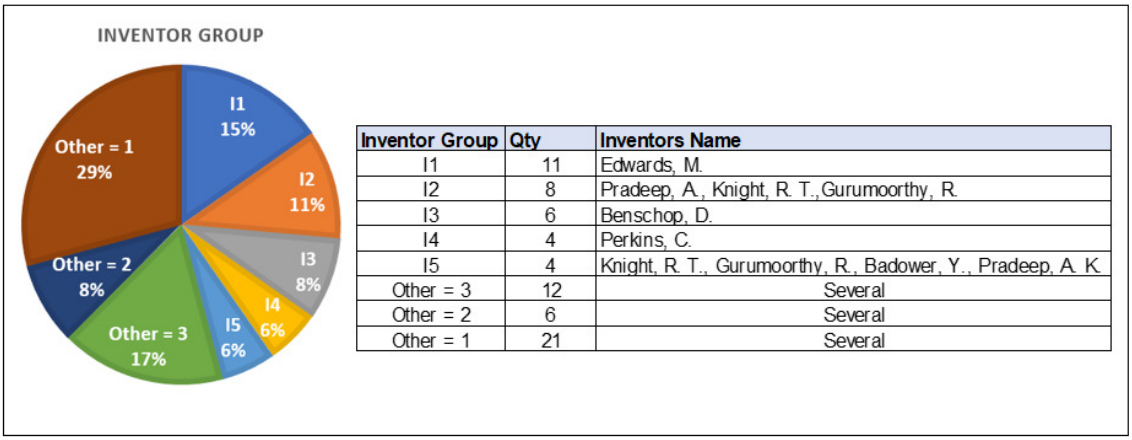
Figure 3. Country or Organization of patent publications



3.3 – Patent Inventor Group

We identified 33 different inventor group for the 72 patents. We found a high concentration of patents in a small group of inventors, since only five different inventors' group filled 46% patents. I5 and I4 groups have four publications and each one represents six percentage of the total publications, I3 has six publications representing eight percentage, I2 has eight publications with eleven percentage of the total while I1, with the most quantity of publications and a single inventor, achieve the value of eleven documents and represents fifteen percentage of the total publications.

The other fifty-four percentage patents can be grouped in inventors groups with less than three publications each (Fig. 4).



Inventor Group	Qty	Inventors Name
I1	11	Edwards, M.
I2	8	Pradeep, A., Knight, R. T.,Gurumoorthy, R.
I3	6	Benschop, D.
I4	4	Perkins, C.
I5	4	Knight, R. T., Gurumoorthy, R., Badower, Y., Pradeep, A. K.
Other = 3	12	Several
Other = 2	6	Several
Other = 1	21	Several

Figure 4. Patents grouped by Inventor

In relation to active patents, five different inventors group correspond to fourth nine percentage of the patents with United States of America owing four groups. The remaining fifty-one percentage of the documents are applicable by different inventor's group with a single application by group.

3.4 – Virtual reality-based marketing research

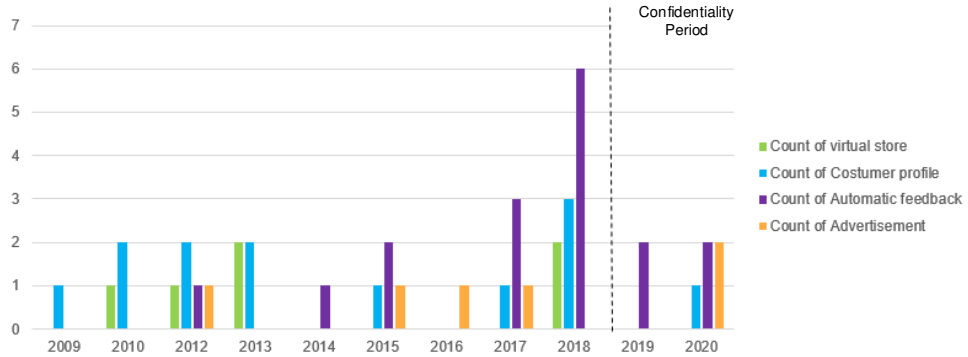
An analysis on the title and/or abstract of the active documents demonstrated that 17 of the documents are correlate with apparatus to automatic read participants reactions in a VR environment, being them gesture, sound, eyes movement or neuro signs. As an example, US Patent 9,886,981 define a device that determines neuro-feedback significance corresponding to stimulus material and modifies the stimulus material using neuro-feedback significance measures [10].

Understanding customer profile applies to 13 documents such as US patent 9,881,310 that create an eliciting system which may embody a method for collecting market research data by eliciting customer input through an interactive competitive game format [11]. VR in advertisement have 6 application. As an example, we have US patent 8,335,716 where characteristics associated with multimedia advertisements are obtained in real time and advertisement slots are offered with information on advertisement slot characteristics and may be selected purchased exchanged and analyzed by advertisers' corporations and firms [12].

Six of the patents are relate to application in virtual stores such as the one presented in US patent 8,341,022 where the invention is a virtual reality system that includes an instrumented device used to present a virtual shopping environment to a simulation participant [13].

Application on understanding or using costumer profile is the most spread and stable application over the years and covers the beginning to the end of the years on the study. The advertisement application and virtual store are also stable and spread among the years but in an average lower than costumer profile. Application on automatic feedback shows the biggest average and with a growing perception. Important to remember that the counting of the last two years may be affected due to the 18 months patents confidentiality period (Fig. 5).

Figure 5. Classification over years



In relation to the classification by source, virtual store applications are identified in five patents from United States and one from Chinese Taipei. Chinese Taipei, India and Japan have one classification in costumer profile while United States have ten documents. In relation to advertisement only Japan and United States are identified

with this classification with two and four applications respectively. Automatic feedback in VR classification has only United States of America patents with seventeen items.

4. CONCLUSION

We found no clear trend that can be established on the patents relating VR application to marketing research.

Regarding to the origin of the active patented technology, there is a concentration in developed countries, with dominance by United States and Japan. Few inventors group dominate the active patents with five groups having fourth nine percentage of total documents and the United States led that with four inventors' groups. We found that patents can be grouped in four application types: automatic feedback, customer profile, advertisement and virtual stores with automatic feedback being the growing application over the years.

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