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***Abstract*- this paper describes a small empirical study aimed at attempting to give an answer to the question: "*will virtual reality provide a substitute for the tourism product*"? It identifies that the development of VR (virtual reality) [1] has enormous potential both for the companies that operate in the tourism sector and for the consumers of their services. It applied the methodology of hypothesis testing using two distinct sample groups: VR researchers who develop and program VR systems, and a cross section of the general public. The findings seem to suggest that virtual holidays are not perceived as an adequate and suitable alternative to 'real' holidays, but have the potential to provide a complement to them. They also show that virtual holidays could play an important role for the disabled and elderly holidaymakers. Several other potential advantages were identified. It is important to reiterate that this was only a small experimental study, but an analysis of its limitations could point the way for further research in this area.**

I. Introduction

This paper presents a small experimental study aimed at researching the question *"will virtual reality (VR) provide a substitute for the travel and tourism product?"* In this context *"product"* is defined as the service provided by the companies involved in the tourism industry.

The potential for a powerful implementation of VR is relatively new [2]. However, even from the early 90's there were discussions in academic Tourism forums and conferences as to the likely impact of this innovation on the tourism industry [3]. The approach taken for this research is to compare the perceptions of the general public with those of a selected group of researchers in the field of VR. These perceptions or attitudes were obtained by analysing their responses to a questionnaire, designed to test a group of predefined hypothesis.

The rationale behind this investigation is the conflict between an increasing requirement for a 'hands on' experience in new tourism sites and the generally accepted need to shield the tourists from the sites that they can merely see, or in some cases to try and shield the sites from the tourists [4]. This emerging radical change has provided the motivation for our research.

II. RESEARCH OBJECTIVES

The research attempted to focus on the future of VR and the role, if any, that it would play in the travel and tourism industry into the 21st century [5]. It started with the premise that, in order to understand this role, it is crucial to compare the views of those people directly involved in the technology with those of consumers who might be affected by the potential of virtual holidays. The methodology chosen was to apply hypothesis testing on the following set of hypothesis:

H1: Consumer demand is becoming more sophisticated resulting in consumer dissatisfaction with conventional holidays, which are also becoming out of favour due to pollution, crime, cancellations, delays, etc.

H2: Consumers currently deem that simulated trips created through the application of virtual reality are appropriate for replacing the need for actually visiting a place.

H3: The success and popularity of virtual experiences and rides at theme parks suggests that consumers would embrace virtual reality holidays if they were available.

The tool used to measure the opinions and views of the subjects was a questionnaire. The construction of this questionnaire required careful consideration, so that consistency could be ensured between the two groups, given their different technological backgrounds. Special care was therefore taken in the phrasing of the questions, and a pilot study was conducted to iron out any potential ambiguity [6]. The sampling design, data collection methods and data analysis technique chosen will be described below in the Sections IV and V.

III. BACKGROUND TO THE RESEARCH

It has been suggested [7] that VR will be able to provide a substitute for the travel and tourism product and that has been the focus of our research. However, it is important to begin by discussing the existing and potential applications of VR in the tourism industry and the role that virtual holidays could play, whether as competitors or complements to the conventional holiday.

A. What is Virtual Reality?

Reference [8] defines virtual reality as *"a fact or real event that is such in essence, but not in fact"*. For a more precise definition, several authors [9], [10], [5] agree that VR is the use of computers and human computer interfaces to create the effect of a three-dimensional world containing interacting objects with a strong sense of three-dimensional presence. In addition, [7] states that VR serves to facilitate access into dimensions that differ from our own.

Therefore, we will assume that the term VR is used to describe systems that attempt to replace much or all of the user's experience of the physical world with synthesised 3D material such as figures and sound. With VR, the user finds himself in the same dimension as and is immersed within the data. Moreover, the experience is augmented with various sensory stimulations such as sight, sound and even touch, together with their respective feedback. These illusionary 3D worlds are created through a combination of visual, audio and kinetic effects where VR participants (in an ideally perfect implementation of the underlying theory) are able to see, hear and touch real life images which make them believe they are actually experiencing the real thing. Even more fundamentally, the virtual objects should react and allow themselves to be manipulated

by the user, making everything in the virtual experience dependent on the visitor's behaviour.

In this idealised VR experience; for instance, the language does not constitute a barrier, since it is postulated that *"virtual language"* is an international means of communication.

The ultimate objective of *"suspension of disbelief"* [11] has not yet been achieved, and the need for specialised hardware: head mounted display units, data gloves, artificial environments, still conspires against this objective. The potential for establishing virtual holiday centres is, however, unquestionable. Therefore, it is pertinent to investigate the current status of virtual tourism.

B. *Virtual Tourism*

Some of the widely accepted and successful forms of tourism already in existence, such as theme parks modelled on foreign destinations, conform to the initial, conceptual, definition of virtual reality given in A above [5]. It has been argued, even before the popularity of theme parks, that the tourism industry has created a spurious reality in many destinations, with fake events and history for tourists to experience and consume [12].

Consumers appear to be content with surrogate travel experiences; already visiting simulated environments, such as theme parks, in record numbers. Disney World is the fourth most popular destination, and according to [13], more and more people are adopting this type of tourism experiences because they are easy, relatively inexpensive, involve no unpleasant surprises and guarantee fun for the whole family. Viewed from this perspective, VR is just another logical step whereby tourism experiences are manufactured to the perceived wishes of the consumers, with the added advantage that these experiences can be tailored to a degree that has not been possible until now.

A new generation of smaller, more adaptable, virtual theme parks or location-based entertainment (LBE), which use VR technology is now evolving, mainly in the USA. They are smaller, cheaper to build and all the rides are re-programmable so potentially more cost effective. One example of this concept is the Cinetropolis complex in Foxwoods, Connecticut [14].

On a completely different direction, two case-studies can be mentioned where virtual reality has been applied with mostly educational purposes: Virtual Stonehenge and the Fantastic Voyage.

Virtual Stonehenge has been developed by English Heritage as an educational, historical and architectural tool, as well as an application that encourages virtual tourism (and preserves the site from the ravages of mass tourism). Users can navigate the environment in ten different eras, stretching as far back as 8500 BC to 2000 AD. They can also move forwards and backwards in time, approach the site from any angle and even fly over the scene.

The Wilson group at the University of California in San Diego has constructed a Virtual Explorer learning tool with which they are developing a "Fantastic Voyage" that allows the user to shrink down to cellular scale and travel through the human vascular system, observing the interplay of the fundamental components of the immune system and the body's response to foreign invaders. This is certainly a trip that could not be done in any other way!

C. *Potential Uses of Virtual Reality in Tourism*

It is possible to identify a number of broad areas where VR technology could be used in the tourism industry, e.g. tourism policy and planning, sales and promotion, and environmental concerns

In tourism policy and planning, VR could be used to generate a virtual tourism destination which tourism planners can enter to plan its development, assess the effectiveness of various planning measures envisaged, and the impacts on the environment and ecosystem of exceeding what is considered the ideal carrying capacity.

As a sales and promotional tool, both tour operators and travel agents will have the ability to offer potential tourists a simulated experience of their planned trip, unlike brochures and videos which are passive tools and only offer short and limited glimpses of a destination. Having "*experienced"* what different destinations have to offer, the client will be in a better position to make an informed decision and initiate travel arrangements [15]. Additionally, destinations that suffer from lack of marketing exposure like developing countries and newly opened Eastern European countries, could be immediate beneficiaries [16].

Finally, VR could contribute to the protection of sensitive environments, either by substituting for the visit, or by illustrating the effects of pollution with a simulation that moves forward in time [17].

D. *The Case for Virtual Holidays*

Returning to the main focus of our research, it has been noted that, as the main tourism generating markets become more sophisticated, they are also becoming more demanding of their experiences: "*increasingly travellers are not prepared to endure the less-than-perfect travel experiences that they are being subjected to, and have already been increasingly looking at surrogate travel experiences that maximise the benefits, and minimise the drawbacks, of travel" [5].*

A survey of the potential advantages of virtual holidays identifies :

- *Hassle-free holidays*, where all the variables can be modified to give the tourist the perfect experience and overcome many of the problems associated with conventional holidays [18].
- *Access to closed destinations, the past and the future,* with the potential to visit inaccessible destinations like the depths of the Amazon jungle or the frozen wastes of the Antartic, or moving forward or backwards in time [19].
- *Opportunity for disabled tourists,* bringing the travel experience to those who are unable, or find it inconvenient, to travel because of physical handicaps or debilitating illnesses.
- *Support for sustainability and environmental conservation,* avoiding visitor resentment by the native population and the deterioration of the natural environment and the habitats of native flora and fauna [18].
- *Virtual conferencing,* which could have a serious impact in the amount of business travel .

E. *The Case against Virtual Holidays*

However, VR holidays have undoubted limitations, such as:

- *The lack of the "real experience",* specially given the social nature of tourism , which can facilitate the interaction with the local culture and heritage, as opposed to mere passive observation.
- *The dependence of poor countries on their tourism revenues,* which would affect a large number of destinations, which are both underdeveloped and remote from the larger tourism consuming areas of the world.
- *Health risks,* which some authors [20] have identified as a consequence of immersion or the use of the VR equipment
- *Limited reminiscence,* curtailing the recording and reliving of the holiday experience and the collection of physical mementos.
- *Social implications* of the creation of a generation of potential VR addicts who are unable or unwilling to communicate with fellow human beings.

F. *Competitor or Complement?*

Undoubtedly, a different scenario would dictate that VR, instead of substituting for the holiday experience, could be used to greater advantage to enhance it. VR could help companies to improve an already existing product. A combination of the real experience and the VR experience could have an immense impact. The users would receive a more complete picture which would tempt them to visit the destination. Some authors [18] see VR's main potential in providing educational opportunities beyond present limitations.

Current trends show that a mature market will prefer more independent and tailored holidaymaking. VR has the capacity of helping meet these needs.

IV. RESEARCH METHODOLOGY

Having examined the background to the research question, the objective of this section is to describe the methodology adopted in our empirical study.

The research objectives and hypothesis have been stated in Section II above. The sampling design and data collection methods will now be described.

G. *Sample size and subjects*

This empirical study had both time and resource limitations, so it was decided to aim for two samples of 50 subjects, one composed of VR researchers and the other of members of the general public. The samples had obviously to be the same size to make comparisons meaningful.

In order to achieve this total, 270 VR research groups were sent the questionnaire by mail, and 93 members of the general public were approached and asked to respond to the questionnaire. This is the total number of subjects contacted, including refusals, rejections and non-responses, to achieve the quota of 100 in all.

The target population of this study was the UK tourist market and responded to a series of simple selection criteria. All respondents had to be aged between 18 and 50 years of age. The reason for the limits was to ensure as far as possible that the participants were responsible for the choice and payment of their holidays, and that there was a reasonable expectation that they would understand and empathise with the idea and possibilities of a virtual holiday. Subjects were also required to have previous and recent travel experience. This was phrased by asking only individuals who had taken at least one week-long holiday abroad over the past 12 months to complete the questionnaire. It was postulated that only people actively taking holidays abroad would be concerned or affected by an alternative product such as virtual holidays.

Because of these constraints, the results of this study do not attempt to draw any conclusions about the UK population at large but only refer to the target population as described above.

VR Researchers: these were people directly involved in VR research and development and programming. They were selected at random (using a random sampling number table) from a list of respondents from a previous research project on the development, uses and applications of VR in the UK [21]. Even if the directory utilised may not include all the organisations involved in VR research in the UK, the sample covered the length and breadth of the UK, including Northern Ireland.

General Public: this was a convenience sample obtained in the streets of Central London at different times and locations, where the questionnaire was personally administered by the researcher. This method was chosen because of its cost effectiveness, high response rates and the ability to collect the questionnaires immediately after completion. [22]. The data for this study was gathered between May and June 1999.

H. *Research instrument*

The tool used was an anonymous three page questionnaire. The time for filling up the questionnaire was approximately 4 minutes and this was declared in the cover note. The sampling process took 5 days for the general public and a month for the mail questionnaires.

There were three main objectives to the questionnaire: include as far as possible all the questions which contributed to the research objectives, word questions in simple, unambiguous and unbiased form and format it so that it would be easy to fill and likely to be completed. The majority of the questions were closed. Those that required recollection were restricted to the past 12 months. In addition, as previously mentioned, holidays of less than a week were excluded. It was preceded by a cover note which introduced the researcher and briefly explained the purpose of the research.

Because VR is a relatively new concept, it was decided that it would be necessary to place a definition at the head of the questionnaire that simply answered the question: *"what is a virtual holiday?"*. It was hoped that it also help to establish a common understanding of the subject of the study between the expert group and the general public.

The questionnaire was divided into three sections, each on a separate page. The first section (Section A) contained background information, which was kept very simple and was intended to make clear to the respondent what virtual holidays entailed. They were asked to tick what they would consider to be the best aspects (from a list of 10) and the worst (from a list of 6) of taking a virtual holiday and how enthusiastic they would be about taking one.

The second section, (Section B) headed *Travel Preferences,* required more time and concentration, was central to the research objectives and aimed at measuring perceptions and attitudes. The responses to this questions were measured in a seven point Likert scale, which was expected to be compatible with the respondent's attitude [23].

Finally, the last page contained two sections, one with demographic information and the last one with two open ended questions to allow respondents' personal views to be reflected.

A pre-test was conducted involving 10 questionnaires (10% of the actual target). The respondents were in this case asked to fill out the questionnaire but also to highlight any ambiguities or mistakes. This pre-test took place in April, a month before the administration of the actual questionnaire, and as a result a series of changes were introduced to the layout of the questionnaire and to the format and phrasing of the questions.

V. Analysis and Interpretation of Findings

The analysis involved ranking the range of responses to the first part of the questionnaire, separately for the two samples. The second part of the questionnaire was analysed using independent samples t-test. Comparisons were also made between demographic data. The results are illustrated below.

I. Section A: Ranking best and worst features

Firstly, the response rate was 19% for the mail questionnaires, which is slightly higher than average, which appears to indicate an interest in the subject of the research. The response rate from the general public was 54%, which indicates that 46% of the people approached refused to take part. It is again a fairly healthy response. It is important to reiterate at this point that the results below cannot be taken as an accurate portrayal of the views of the whole of the UK but only of those who responded, with the sampling limitations already identified.

The first question identified whether the respondent had previously heard about virtual holidays. As expected, a large proportion (72%) of the VR researchers knew about them in advance of our research, whereas only 16% of the general public did. This last figure is, in fact, larger than we anticipated.

The ranking of best and worst aspects by each of the samples is illustrated in tables I to IV. It is important to reiterate here that the objective of this section was to serve as an introduction to the more thoughtful questions in the *Travel Preferences* Section. It is also necessary to point out that since each respondent had the possibility of selecting as many or as few options as desired, the sum of the percentage responses will not equal 100%. Rather , the individual percentages represent the proportion of respondents who selected each option.

TABLE I
VR RESEARCHERS RANKING OF BEST FEATURES

Option	No. of Ticks	%	Ranking
Convenience and ease	7	41	7th
Saves travelling time	9	18	6th
Cheaper (no insurance, risk of injury)	5	10	9th
Opportunity for the disabled	21	42	2nd
Preserves the natural environment	14	28	4th
Ability to experience life in the past or future	11	22	5th
Opportunity to areas closed to tourism	17	34	3rd
Experience destination before booking	37	74	1st
No risk of accidents, harm, delays, pollution, bad weather, etc.	6	12	8th
Other	1	2	10th

TABLE II
GENERAL PUBLIC RANKING OF BEST FEATURES

Option	No. of Ticks	%	Ranking
Convenience and ease	23	46	=5th
Saves travelling time	7	14	8th
Cheaper (no insurance, risk of injury)	23	16	=5th
Opportunity for the disabled	27	54	3rd
Preserves the natural environment	11	22	7th
Ability to experience life in the past or future	24	48	4th
Opportunity to areas closed to tourism	33	66	2nd
Experience destination before booking	41	82	1st
No risk of accidents, harm, delays, pollution, bad weather, etc.	4	8	=9th
Other	4	8	=9h

Interestingly, both the general public and VR researchers believe that the best aspect about virtual holidays is the possibility of experiencing the destination before travelling. However, they believe that the next more important aspect is that people can visit places which are no longer open to tourism, whereas VR researchers placed opportunities for the disabled in second place. Since these rankings are merely reversed, these features are considered similarly important and it is not possible to read too much into this difference. Another intriguing finding is that both VR researchers and the general public consider the risks associated with conventional holidays unimportant. This perception is further confirmed in the analysis of the second part of the questionnaire.

TABLE III
VR RESEARCHERS RANKING OF WORST FEATURES

Option	No. of Ticks	%	Ranking
Not actually experiencing the real thing	43	86	1st
Being unable to apply for visas, change money and travel to destination	4	8	5th
Countries that depend on revenue will suffer	14	28	3rd
Multiple identities, different genders and virtual bodies causing psychological problems	7	14	4th
Tourism simply becomes artificial entertainment	17	34	2nd
Other	1	2	6th

TABLE IV
GENERAL PUBLIC RANKING OF WORST FEATURES

Option	No. of Ticks	%	Ranking
Not actually experiencing the real thing	42	84	1st
Being unable to apply for visas, change money and travel to destination	4	8	6th
Countries that depend on revenue will suffer	27	54	2nd
Multiple identities, different genders and virtual bodies causing psychological problems	9	18	4th
Tourism simply becomes artificial entertainment	22	44	3rd
Other	7	14	5th

Again, there is agreement as to the most important worst feature, being the lack of the genuine experience. There is also again a reversal in the 2nd and 3rd positions, which could either be interpreted as less concern for poor countries on the part of the VR researchers or lack of understanding of the idea of *"artificial entertainment"* in the general public.

Seven individual respondents offered alternative suggestions in the "other" section, ranging from "no hangovers, other people" to "hastens move towards isolated individualistic society where genuine social interaction is minimised" , which can be seen as different elaborations of the lack of a genuine experience.

J. *Section B – Travel Preferences*

Having established the characteristics of virtual holidays in the previous section, this second section, with responses organised in a 7 point Likert scale, could be further subdivided into three groups of five or six questions that were intended to either substantiate or disprove each of the 3 research hypothesis stated in Section II.

T-tests were carried out on each of these questions, to ascertain whether significant differences could be identified between the perceptions of VR researchers and the general public. A summary of findings is given in Tables V, VI and VII. The mean value corresponds to the 7 point Likert scale, with 7 being *strongly agree* and 1 being *strongly disagree*. The t-test was calculated at .005 significance, 2-tailed. A tick in the "significant?" column indicates the difference between the samples is significant at that level. It must be pointed out that the questions were more detailed and elaborate, but have been reduced in the interests of brevity.

TABLE V
HYPOTHESIS 1: CHANGING CONSUMER DEMAND

Question	Mean (VR researchers)	Mean (General Public)	Significant?
Fed up with inconveniences of conventional holidays	2.42	3.28	√
My last holiday did not meet expectations	1.68	1.80	
Ability to adopt a virtual body , re-live historical experiences, etc. appeals greatly	3.22	3.30	
Potential effects of virtual situations	2.66	4.12	√
Would consider taking a virtual holiday	3.74	4.78	√

The figures in Table V appear to indicate that people (both VR researchers and the general public) are not particularly unhappy with their conventional holidays, and are not terribly concerned

about what could be seen as the inconveniences associated with them.

Moreover, significant differences were found between VR researchers and the general public in terms of their concern for virtual experiences' side effects and their interest in trying a virtual holiday. Some of these differences could be attributed to the differences in their understanding of the technology. It is perhaps surprising that VR researchers are less inclined to try a virtual holiday. A possible interpretation would be that they are aware (or perceive them) as not particularly special, and are reluctant to continue with the same activities they carry out at work during their holidays.

From this findings it appears as if our first hypothesis cannot be entirely substantiated, even if there exists a certain interest in virtual holidays among the general public interviewed.

TABLE VI
HYPHOTHESIS 2: SIMULATED EXPERIENCES

Question	Mean (VR researchers)	Mean (General Public)	Significant?
Simulation will never replace the actual experience	6.08	5.30	√
Demand would increase if simulated experiences of a trip were offered	4.10	4.32	
Like interacting with local people and culture	5.76	5.98	
Take holidays to develop language skills	4.02	3.76	
Would enjoy visit to area now closed	4.36	3.94	
Virtual experience would increase desire to visit destination	4.38	4.38	

There is clear rejection from both groups for the main tenet of our second hypothesis. Only one significant difference was found, indicating that the VR researchers are significantly less inclined to replace their conventional holidays by virtual. Both groups are, however, totally disinclined, and one of the reasons appears to be the lack of interaction with local people and culture. Moreover, both groups agree equally that a virtual experience would be useful prior to a visit.

TABLE VII
HYPOTHSIS 3: THEME PARK SUCCESSES

Question	Mean (VR researchers)	Mean (General Public)	Significant?
Excellent opportunity for disabled tourists	5.44	5.80	
Progression from theme park virtual rides	4.16	4.12	
Like visiting theme parks	3.64	4.14	

Again, our last hypothesis appears to be disproved by the responses of this sample. The only area where there was substantial agreement was the proposition that virtual holidays would offer an excellent opportunity for disabled tourists. No significant differences were found between the attitudes of the VR researchers and the general public.

The demographic information did not appear to have any explanatory potential, so no attempt was made to identify any patterns derived from it. In general, the VR researchers were slightly older than the general public sample. The balance of genders was fairly good, with a higher proportion of males than females in the VR researchers sample, and a higher proportion of females in the general public sample. On average, the VR researchers' income was higher than that of the general public.

VI. Conclusions and Suggestions for Further Research

Our limited empirical study seems to indicate that there is a current consensus among UK tourists that virtual holidays cannot replace the real holiday experience, regardless of apparent inconveniences and environmental dangers to destinations. There also appears to be a consensus that virtual holiday experiences have a place as a preparation for visiting a destination, for disabled tourists and to experience destinations currently closed to tourists. There do not appear to be serious significant differences between VR researchers and the general public in these areas, except for a higher reluctance to try virtual holidays on the part of the researchers.

There are a number of suggestions for further research that emerge from this study, mostly to do with the limitations already indicated earlier. A sample taken from a more global perspective would have given a more realistic indication of the potential of virtual holidays, in the current globalised tourism market.

Moreover, no attempt was made here to look at individuals taking holidays at home in the UK and for shorter periods of time. There is the potential that virtual holidays will totally replace the short break, avoiding the need to travel for short stays.

Finally, in order to be able to generalise the results, a larger and more representative sample of the general public would obviously be necessary. Also, the opinions of disabled people would be of great relevance in view of the results obtained.

Finally, the very nature of the research subject means that it is constantly changing, and a very similar survey carried in a year's time could yield different results. Not only are providers in the tourism industry having to adapt to changing styles, but technology progresses at great speed and political instability may force consumers to make new decisions.

What does the future hold? Predictions about the impact of new technologies are unreliable. But the creation of linked up home networks will make VR even more desirable as it would involve the user in even less effort to experience it. We believe that the future depends on whether VR can achieve one of its ultimate goals : *"to provide a completely natural experience in realistic simulated worlds" [24].*

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