The Effects of **Environmental Interpretation** on **Visitors' Knowledge**, **Attitudes** and **Behavioural Intentions** at the Charmouth Coastal Area, in the U.K.

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Abstract | This study examines the effectiveness of interpretation on visitors' knowledge, attitudes, and behavioural intentions towards environmental conservation at the Charmouth coastal area, in the U.K. In addition, the study explores how the interpretive experience influences pro-environmental behavioural intentions along with other various variables. A pre-/post-visit questionnaire survey was conducted on-site. Results indicate that interpretation is successful in enhancing visitors' knowledge of the environmental issues and promoting their behavioural intention. The interpretive experiences of visitors facilitate only the specific attitude related to fossil collecting activities, but no overall attitude change. In terms of the effects of various factors on behavioural intention, attitudes are more influential than knowledge. The visitors' background and experiences are also moderately related to behavioural intention. Therefore, this study suggests that interpreter's need to approach in a more holistic and integrated basis to develop effective interpretation practice in order to promote responsible environmental behaviour.

Keywords | Interpretation, Knowledge, Attitude, Behavioural Intention, Sustainable Tourism.

Resumo | Este estudo examina a eficácia da interpretação no conhecimento, atitudes e intenções de comportamento dos visitantes, no que se refere à conservação ambiental da área costeira de Charmouth, no Reino Unido. Adicionalmente, o estudo analisa de que forma a experiência interpretativa influencia intenções de comportamento pró-ambientais, conjuntamente com outras variáveis. Um estudo por questionário pré e pós visita foi realizado no local. Os resultados indicam que a interpretação tem sucesso no que se refere a melhorar o conhecimento dos visitantes sobre as questões ambientais e a promover as suas intenções de comportamento. As experiências interpretativas dos visitantes facilitam apenas a atitude específica relacionada com a recolha de fósseis, mas não uma mudança de atitude em termos globais. Relativamente aos efeitos dos vários factores nas intenções de comportamento, as atitudes influenciam mais do que o conhecimento. O passado e as experiências dos visitantes estão também moderadamente relacionados com as intenções comportamentais. Neste sentido, este estudo sugere que o intérprete necessita de abordar uma base mais integrada e holística para desenvolver uma prática interpretativa efectiva, de modo a promover um comportamento ambiental responsável.

Palavras-chave | Interpretação, Conhecimento, Atitude, Intenção Comportamental, Turismo Sustentável.

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1. Introduction

As concern has grown about the negative impacts on the environment caused by tourism development, sustainable tourism has become one of the most popular concepts in the tourism industry (Tubb, 2003). However, "the concept of sustainable tourism development and management suggests that the potential conflicts between tourism activities and resource protection can be resolved by maintaining a balance between the needs of resources and visitors" (Kuo, 2002:87). Therefore, visitor management is considered to be a true tool of sustainable tourism management as it aims to reduce inappropriate visitor behaviour, as well as enhancing the quality of the tourism experience while sustaining the quality of tourism resources (Cooper *et al.*, 1998, Kuo, 2002). The objectives of visitor management can be achieved through the two major approaches which are "interpretation" and "regulation". Many researchers supported the idea that environmental interpretation can play an important role as an effective visitor management tool for effective management, conservation and sustainable tourism development rather than regulations or rules (Cooper *et al.*, 1998; Moscardo, 1998; Kuo, 2002; Tubb, 2003).

As defined by Tilden (1977:8), interpretation is "an educational activity which aims to reveal meaning and relationships through the use of original objectives, by first-hand experiences, and by illustrative media, rather than simply to communicate factual information". Recently, the educational role of interpretation emphasised by Tilden has seemed to shift to the management goals of interpretation in the natural area or the protected area. The use of interpretation has become a widespread management technique within many natural resource management professions (Sharpe, 1982; Knudson, Cable and Beck, 1995; Ham, 1992; Tubb, 2003).

Despite the well-known support for environmental interpretation as a solution to minimising tourists' impacts on the natural and cultural environment while enhancing the quality of their experiences, there has been little empirical research or evaluation to determine whether and how interpretation helps to develop visitor understanding and modify their attitude and behaviour (Hall and McArthur, 1996; Orams and Hill, 1998; Kuo, 2002). In response to the need of the research, this study aims to evaluate the effectiveness of interpretation in promoting responsible behaviour toward environmental conservation at the Charmouth coastal area, U.K. This study also attempts to investigate the extended relationships between attitudes, knowledge, and behavioural intentions of the visitors as well as other visitor characteristics variables.

1.1. The effect of interpretation as a visitor management tool

In reviewing the role of interpretation, a number of objectives of interpretation were identified in various ways and levels of detail as follows: promotional objectives, recreational objectives, educational objectives and management/conservation objectives. Many objectives of interpretation were evaluated, but most of the research focused on the recreational effectiveness of the programmes in holding the visitors' attention and enhancing visitors' enjoyment and satisfaction in relation to the museum study (Light, 1991). There was less attention given to the management or educational objectives of interpretation. There are significant differences between educational objectives which are used mainly in the study of museums or heritage sites and management objectives of interpretation in protected areas or natural sites. In other words, educational objectives aim to increase visitors' knowledge and understanding of the environment and culture. Beyond greater levels of knowledge gains, management/ conservation objectives of interpretation are the reduction of inappropriate behaviour and the encouragement of environmentally responsible behaviour toward the conservation of the site

(Sharpe, 1982; Beckmann, 1991; Wearing and Neil, 1999). Therefore, the evaluation of the conservation objectives of interpretation can make a significant contribution to effective visitor management through influencing where visitors go and informing visitors about appropriate behaviours (Moscardo, 1998). For example, inappropriate behaviour by visitors may cause negative environmental impacts and this may be due in some cases to visitors simply not being aware of the potentially negative environmental impacts of their activities (Tribe *et al.*, 2000). In this way, the management/conservation objectives of interpretation should be emphasised and evaluated in future. Through a continuing evaluation and feedback, successful interpretation, if planned carefully and sensitively, can lead to the achievement of the goals of sustainable tourism development for both the quality of tourism experiences and the conservation of the environment (Moscardo, 1998; Tubb, 2003; Archer and Wearing, 2003).

However, due to the complexity and difficulty of influencing attitude and behaviour, the effect of interpretation upon attitudes and consequent environmental behaviour has been a topic of much debate (Thom, 1980; Cable *et al.*, 1987; Orams, 1997). Nevertheless, several efforts have been directed at determining the effect of interpretation programmes on attitudes and behaviour. Up to now research findings suggest that interpretation programmes can help to enhance the quality of visitors' experience and knowledge of the features of the site. In turn, visitors may be influenced to be more environmentally aware of and modify their previously inappropriate behaviour (Cooper *et al.*, 1998; Moscardo, 1999; Kuo, 2002; Beaumont, 2001; Tubb, 2003). However, the results of the effects of interpretation on knowledge, attitudes, and behaviour have been mixed (Cable *et al.*, 1987; Orams, 1997; Beaumont, 2001; Kuo, 2002). For example, several studies found both increased knowledge and attitude change after experiencing the interpretation (e.g. Olson, Bowman, and Roth, 1984; Nielsen and Buchanan, 1986; Madin and

Fenton, 2004). However, some of the studies showed the mixed results achieved, with the provision of increased knowledge leading to limited favourable attitude change (e.g. Lee and Balchin, 1995; Tubb, 2003) or leading to no significant improvement in attitudes (e.g. Eagles and Demare, 1995, in Beaumont, 2001). The reasons for these unclear results may include a number of correlating factors regarding the measurement of knowledge and attitudes, as well as, the interpretive programme itself or the visitor's traits (Beaumont, 2001). It indicated that, in terms of attitude and behaviour change, the application of interpretation in recreational sites is not always easy, and its effects may not be immediate or as the result of a single interpretive experience (Orams, 1997).

In response to the increasing criticisms and limitations of interpretation to date, Moscardo (1996) suggested that some integrative theoretical framework to guide both future visitor studies and the design of interpretation is clearly necessary to develop the effects of interpretation on attitude and behaviour change. While such research reviews are valuable, it is essential to approach in an extended insight perspective for future research into the evaluation of the effectiveness of interpretation.

1.2. Conceptual framework for visitors' attitude/behaviour change by interpretation

Several theories and conceptual models related to attitudinal and behavioural change have been developed and applied to developing effective interpretive programmes for the management and conservation purpose in tourism settings. Research suggests that the conceptual models can help to increase the understanding of the complexities of the interpretive experience and its relationship to visitor behaviour for the outcomes of effective interpretive techniques.

For current study, in particular, the two main models in the context of the interpretation fields

were reviewed as follows: (1) Moscardo's (1999) mindful/mindless model. (2) Orams' (1996) model of "features of an effective education programme for the tourist".

First, the "mindful/mindless" model by Moscardo (1996) focused on the flow of the relationship between two types of visitor profiles (mindful/ mindless) and interpretation factors to promote visitor behaviour and cognition at built heritage sites. This model indicated that the different outcomes of the effects of interpretation were influenced by both different types of visitors and effective interpretive technique factors. This conceptual model suggests that targeted interpretation must start with a detailed understanding of the visitors' backgrounds, not only in terms of the basic demographics but also in terms of psychographic information and interpretation experiences.

With regard to visitor factors, the previous researchers identified several important variables including age, educational level, group size, group composition and distance of travel as the visitors' demographic background factors. Also, reasons for visiting, existing attitudes toward the interpreted site, the probable activities to participate in, length of stay, levels of interpretation participation, and previous experiences were considered as psychographic information and interpretation experience factors (Knudson *et al.*, 1995; Cooper *et al.*, 1998; Ballantyne, Packer, and Beckmann, 1998; Moscardo, 1999). Therefore, in the complex nature of developing the effective interpretive programmes, this model indicates that it is necessary to understand the relative contributions of interpretive programmes and visitor characteristics on the desired outcomes of interpretation experiences.

The second model proposed by Orams (1996) provided an insight understanding of the process of how visitors' behaviour is influenced by several internal factors. The major important factors selected in this model include the cognitive and affective domains and behavioural intention in managing negative impacts of visitors and promoting pro-

-environmental responsible behaviour. This linear model between knowledge, attitude, and behaviour is based on the psychology and learning theories.

Through the review of the psychology and learning theories, it has been argued on the question of changing people's behaviour in the context of the environmental conservation. Early studies on environmental behaviour have focused on the assumption that knowledge is linked to attitude, and attitude to behaviour in a linear model (Cottrell and Graefe, 1997). This traditional thinking addresses that "if people become more knowledgeable about environmental issues, they will, in turn, become more aware of the environment and its problems and, thus, be more motivated to act toward the environment in a more responsible way" (Hungerford and Volk, 1990). In response to this, Orams (1997) also suggested that interpretation could potentially promote more environmentally responsible behaviour by increasing visitors' understanding of conservation needs and affecting their attitudes.

However, the linear model of environmental behaviour has not been seen as valid or true, because there are a number of variables influencing an individual's responsible environmental behaviour (Hungerford and Volk, 1990; Cottrell, 2003). To date, researchers have examined the relationship of several main variables (i.e., environmental attitudes, intention to act, knowledge of the issues) with responsible environmental behaviour as well as situational factors or other personality factors (i.e. locus of control, responsibility, social norm, sexual role, sensitivity) to create environmentally responsible behaviour (Newhouse, 1990; Hwang *et al.*, 2000).

The brief reviews of two conceptual models above support the view that identifying previous variables and understanding their relationship to visitor behaviour, is the prerequisite in promoting responsible environmental behaviour (Newhouse, 1990). In response to this, for evaluating and developing the effectiveness of interpretation, it can be critical to make a decision about what kind of antecedent variables are selected and how to

measure those variables. For this study, we selected the three main antecedent variables in the process of behavioural change, based on psychological theories or models, which include knowledge, attitudes, and behavioural intentions. This study focuses on assessing how visitors modify their behaviour after experiencing interpretation with consideration given to a combination of correlated knowledge or attitudinal components and other visitor variables (Kuo, 2002; Cottrell, 2003).

1.3. Relationships between knowledge, attitude, and behavioural intention

As mentioned earlier, it is a very complex and inconsistent process to promote attitude and behaviour. This section reviews in more detail how three major antecedent variables are related to environmental behaviour and how they are defined and measured.

Cognitive component: knowledge

Knowledge is one of the base components of the model proposed by Hines *et al.* (1986/87) and Orams (1996). However, the researchers have emphasised that "an individual must possess knowledge of action strategy which is available and which will be most effective in a given solution" rather than simple factual knowledge to predict responsible environmental behaviour. (Hines *et al.*, 1986/87: 6). That is, while an increased level of environmental knowledge will not automatically lead to behaviour change, researchers imply that an individual's knowledge of environmental issues or action skills is more important to decision making within the natural environment and is considered to be a pre-requisite to appropriate action (e.g. Hines *et al.*, 1986/87; Hungerford and Volk, 1990). When applied to the effect of interpretation in tourism, the results of the research proved that the effects of interpretation influenced knowledge gain and increased positive behavioural intention, but only to

a limited extent (Dowell and McCool, 1986; Stubbs, 1991, in Reid and Marion, 2003). For example, Stubbs (1991, cited in Reid and Marion, 2003) assessed the effectiveness of a wilderness trailhead sign on visitor knowledge, behavioural intention and actual behaviour. The results of the study found that trailhead signs were only slightly effective in increasing visitor knowledge levels, behavioural intention and behaviour. Stubbs (1991) found the reasons from the interpretation techniques including the complexity of the message and the difficulty of conveying the message through a trailhead sign. With regard to suggestions drawn from the literature, the present study focused on the concepts of knowledge about the specific local environmental issues or the appropriate behaviour for conservation, rather than simply factual knowledge measurement.

Affective component: attitude

Several researchers have emphasised that interpretation or outdoor environmental education can and should be concerned with the development of attitudes, responsibilities, and appreciation toward nature and the environment because attitude is considered as the best predictor of behavioural intentions (Bogner, 1998; Orams, 1997; Newhouse, 1990). According to the review of the attitude construct, there is no consensus of the definitions and conceptualisations of attitudes. To date, most researchers have agreed that attitudes are multidimensional, consisting of three components – belief (the cognitive component), feelings/ emotions (the affective component), and intention (the conative component) (Cottrell, 2003). According to Azjen and Fishbein (1980), there are different types of conceptualisation of the attitude construct which include: general attitudes toward objects; more specific attitudes toward certain issues; and attitudes toward taking an action. Researchers have suggested that attitude toward action or the specific attitude was strongly correlated to environmental behaviour (Hines *et al.*, 1986/87; Newhouse, 1990). Based on these assumptions, the instrument to

measure attitudes in this study focused not only on both beliefs and feelings about environmental issues and tourism impacts, but also on attitudes toward the specific local environmental issues and the problem actions.

Conative component: behavioural intention

Behavioural intention can be understood as the expressed willingness to act upon a certain action (Hines *et al.*, 1986/87; Hungerford and Volk, 1990). Behavioural intention can be used when it is not possible to measure revealed behaviour. Many other studies have also found that environmental behaviour intention is strongly related to environmental behaviour, or at worst moderately related (Hines *et al.*, 1986/87; Cottrell and Graefe, 1997; Hwang *et al.*, 2000). However, there might be a bias between actual behaviour and behavioural intentions (Kuo, 2002, Hwang *et al.*, 2000). In tourism settings the measurement of behavioural intention as behavioural modification would be more efficient and practical than trying to observe the behaviour changes directly (Cable, Knudson, and Theobald, 1986).

2. Study objectives

The current study aims to examine the effects of the interpretive programmes (particularly, the Charmouth Heritage Coast Visitor Centre) on visitors' knowledge, attitudes and behavioural intentions toward environmental conservation issues at the Charmouth coastal area, in the U.K. This study also aims to provide an overall view of how behavioural intention toward conservation are influenced by several factors such as knowledge and attitude variables, as well as connections with visitor factors and interpretation experiences.

The three selected variables to promote positive behaviour toward coastal conservation were: (a) knowledge of geology/fossils and conservation issues as well as responsible behaviour related to visitor

management policy at the Charmouth coastal area, (b) attitudes including beliefs and feelings regarding conservation issues and problem issues related to tourism as well as fossil collecting activities, (c) behavioural intention (verbal commitment) toward appropriate behaviour for environmental conservation. The main objectives of this study were explored through the two main stages as follows:

Stage 1
– To provide profiles of visitors to the Charmouth coastal area (e.g. their motivation to visit the site, pre-environmental experiences and involvement, group size, residence, age, gender, and use pattern of interpretive programmes);
– To determine the direct effects of the visitor centre on knowledge, attitudes and intentions;

Stage 2
– To examine the relationships between knowledge, attitudes and intentions;
– To investigate the most influential factors in influencing behavioural intentions.

The following hypotheses are assessed to determine which variables serve as the major influential variables to responsible environmental behaviour.

– *Hypothesis 1*: Behavioural intention is positively related to both attitude and knowledge of environmental issues;
– *Hypothesis 2*: Behavioural intention is positively related to visitor characteristic variables, interpretive experience, knowledge and attitude variables.

3. Methods

3.1. Charmouth Heritage Coast

The study was undertaken at the Charmouth Heritage Coast Visitor Centre in South-West Dorset,

England which is part of the Jurassic Coast World Heritage Area. This area is protected through national designations as a "heritage coast", "World Heritage Area" and "Area of Outstanding Natural Beauty (AONB)". Dorset's Jurassic Coast was awarded its status for being a significant earth science site as the first natural World Heritage Area in the UK (Jurassic Coast Team, 2004). Charmouth Heritage Coast is considered especially important as one of the coastal Earth science heritage sites (Hose, 1995) and also is popular for fossil collecting activities to attract both tourists and students and researchers (Charmouth Heritage Coast Centre, 2005). This Earth science heritage resource consists of natural rock outcrops (or fossils) and man-made buildings and museum displays. With the outstanding and unique natural attractions along with the Jurassic coastal areas, recently, "geotourism" has been developed in this site. Hose (1995) defined "geotourism" as offering both a new packaged tourism product and the potential to constituency-build for geological heritage conservation.

However, there is growing concern that negative impacts resulting from the increasing numbers of visitors might cause environmental destruction of the site. In particular, cliff erosion is the specific environmental issues in this area because the cliffs are formed by a mudslide named "Black Van" between Lyme Regis and Charmouth which is the site of one of the largest coastal mudslides in Europe. The coastline of this site is eroded rapidly by sea after rough weather and by visitors who climb the cliffs. The protection of the cliff erosion is the most important issue at this site (Brunsden, 2003). In response, the interpretation plans have been developed to manage visitors toward the sustainable tourism development goals and conservation of geological and coastal environment in this area (Hose, 1995; The Natural History Museum, 2003).

With regard to the primary management/ /conservation goals of interpretation, it is suggested that this can be achieved by enhancing visitors' knowledge and understanding of the specific environmental issues and action skills for protection of the cliff erosion as well as promoting favourable attitudes and responsible behaviours toward conservation at the Charmouth coastal area (The Natural History Museum, 2003). For example, according to the primarily informal interviews with the staff in the visitor centre and its publications, the site-specific appropriate visitor behaviour (e.g. "not climbing to the cliffs", "not digging on the cliff face", and "collecting the fossils only from the beach") are encouraged by the site managers and the agency.

In addition, various interpretive programmes in this area include signs, brochures, publications, the Charmouth Heritage Coast Visitor Centre itself, films and a guided walk. In particular, the Charmouth Heritage Coast Visitor Centre, which is located on the first floor with a fossil shop in the ground floor, has opened to the public since 1985. Interpretation within the visitor centre, contain a variety of programmes such as films, interactive computers, exhibition models, display boards, publications and a guided tour walk for fossil collecting and observing marine life. The visitor centre is quite small but it is organised well, containing a staff office, a front desk for the sale of books and other souvenirs and a model of a fossil within the middle of the centre. The themes of interpretation within the visitor centre focus on the biodiversity of the local area, geology, fossils, marine life, cliff erosion issues, and water pollution and beach litter issues (Charmouth Heritage Coast Centre, 2005).

The brief review of background of the Charmouth coastal area shows that this case study site is suitable to be investigated for the purposes of this study. In particular, the main site-specific environmental issues and responsible behaviour were applied to develop operational concepts in measuring three indicators (knowledge, attitudes, and behavioural intentions). In order to investigate the effects of the overall interpretive programmes on visitors' knowledge, attitudes, and behavioural intentions at the Charmouth coastal area, the main

objective of this study focused on an examination of the direct effect of the Charmouth Heritage Coast Visitor Centre. Additionally, the level of use of interpretive programmes was also included in the further analysis.

3.2. Survey and data collection

This study selected pre- and post-visit questionnaire survey for the evaluation of the effects of interpretation. This methodological approach for questionnaire surveys is different from exit surveys. Lee and Balchin (1995) suggested that the previous studies using "exit surveys" have been described as methodologically weak, because "exit surveys"are unlikely to assess prior attitudes accurately and are prone to "faking good" in appreciation for the hospitality of the visit. Alternatively, the more acceptable survey technique is to compare the results of independent pre- and post-visits samples (Lee and Balchin, 1995; Beaumont, 2001; Tubb, 2003). Many researchers supported the idea that pre- and post-visit samples selected at random enable us to assess the obvious effect of the messages and media on visitors' attitudes and their behaviour change (Beaumont, 2001; Tubb, 2003). In this case, the same people could not be interviewed both before and after they had experienced the interpretive programmes as they would have been "sensitised" by pre-visit interviews, producing a biased response (Lee and Balchin, 1995; Tubb, 2003).

The visitor survey was undertaken in August 2004, with a total of 207 respondents obtained from 260 distributed questionnaires. The survey sample targeted British day visitors (over 18 years old) as the majority group of the tourists visiting the Charmouth coastal area. The self-administered questionnaires were collected by research assistants and participants were thanked for their cooperation. Among a total number of 207 participants in the study collected, there were 92 pre-visit samples who had not visited the Charmouth Heritage Coast Visitor Centre and 115 post-visit samples that had experienced the centre.

Independent pre- and post-visit samples were selected at random. The pre- and post-visit samples were screened to ensure that they had not already taken part in the survey. In particular, researchers suggested that the profiles of pre-visit and post--visit samples needed to be similar to compare directly the effects of interpretation on the main indicators (Orams, 1997; Lee and Balchin, 1995). Lee and Balchin (1995) suggested that the increased variance can be controlled by matching the groups or by making them sufficiently large to rely on randomisation to achieve equivalence.

When carrying out the visitor survey, it was difficult to approach the visitors who had just arrived at the car park and had refused offers of participation in the survey by visitors. Therefore, any of the visitors approaching the car park and beach area were asked whether they had been to the visitor centre. If they had no experience of the centre, they were asked to complete a pre-questionnaire (pre--visit group). At the entrance of the visitor centre, visitors were asked whether they had participated in the visitor centre. If they had, they were asked to complete a post-questionnaire (post-visit group). Although there is limitations and difficulty in controlling the visitor groups according to the visitor centre experience, this data from visitors at various stages of their trip was also potentially useful in investigations of the profile of visitors who had not been to the visitor centre and the impacts of various other interpretive components on visitors' attitudinal variables (Moscardo *et al.*, 1997).

4. Instrument

The final version of a self-administrated questionnaire included the visitor demographics and trip information, and three subscales which comprised knowledge, attitudes, and behavioural intentions.

4.1. Visitor characteristics

To create a profile of visitors to the Charmouth coastal area, the additional questions were included to allow for examinations of potential differences in the experiences and responses of different types of visitors. Socio-demographic variables were measured including gender, age, education, residence, and travelling group composition. The survey sought details of other trip attribute variables including "motivation", "environmental involvement", "previous visits to natural areas", and "previous visits to the Charmouth coastal area". Interpretation variables contain "the level of use of interpretive programmes", "reading of the code of conduct for fossil collecting brochure" and "past experiences of the visitor centre".

In particular, motivation variables composed of 12 examples from Ballantyne *et al.* (1998) and Moscardo *et al.* (1997) were measured on a 5-point Likert-type scale (1 = very important and 5 = not at all important). The reliability coefficient for the overall scale ($\alpha = 0.74$) was relatively moderate. Factor analysis suggested that there were four types of motivation for visiting the Charmouth coastal area accounting for 67% of the total variance in the sample. On the basis of items' loading (>0.05) on each factor, four factors were identified and labelled: (1) learning about geology and fossils, (2) enjoying nature, (3) beach activities (e.g. swimming and meeting other people), and (4) having fun with family/friends. Cronbach's alpha for the five factors ranged from 0.58 to 0.82. This provided support for its use as a latent construct.

4.2. Knowledge measurement

In this study, the concept of knowledge was restricted to knowledge of environmental issues and management policies related to the appropriate behaviour for the visitors to the Charmouth coastal area. A self-assessed knowledge method and open-ended questions were employed to measure environmental knowledge.

Firstly, a self-rating method was used to adequately measure a respondent's understanding of the environmental concepts in previous researches (e.g. Moscardo *et al.*, 1997; Beaumont, 2001; Madin and Fenton, 2004; Cottrell, 2003). Moscardo *et al.*, (1997) supported the idea that self-ratings of knowledge are useful indicators of the extent to which people have been made mindful or thoughtful.

For this study, knowledge items consisted of 12 self-rating items with a 5-point Likert-type scale (1 = no knowledge at all and 5 = excellent knowledge). Those items were divided into five areas developed from the review of several studies by Beaumont (2001), Howard (2000), and Madin and Fenton (2004). Respondents were asked to rate their understanding of environmental issues regarding geology, fossils, marine life, conservation issues, and the visitor code for appropriate behaviour specifically presented in the interpretive programmes at the Charmouth coastal area. Moreover, open-ended questions were combined to address concepts requiring the respondent to recall information. It allowed us to see how newly acquired knowledge became implanted in the structures of existing knowledge (Tubb, 2003). The special environmental issues (e.g. cliff erosion, safety, and inappropriate behaviour causing a negative impact on environment) related to the Charmouth coastal area were examined in open-ended questions to provide an indication of the respondent's detailed and conceptual understanding.

4.3. Attitude measurement

Attitude statements used in the survey focused on this coastal area to reflect the diversity of information provided within the centre or by the interpretive programmes on-site. These attitude items were developed with a combination of

existing measurement statements by Tubb (2003), Madin and Fenton (2004), and Orams (1997). Attitude statements consisted of 10 questions rated on a 5-point Likert-type scale, defined by the labels, "strongly disagree", "disagree", "neutral", "agree", and "strongly agree". Most of these were cognitive/belief-type statements but emotional items were included. The four main concepts included as follows: beliefs about the significance of conservation (Tubb, 2003), tourism impact on the coastal environment (Madin and Fenton, 2004), awareness of pollution on the coast (Orams, 1997; Madin and Fenton, 2004), and perception of tourist activities (e.g. "visitors should not collect fossils", "collecting fossils damages the environment" adapted from Tubb, 2003).

4.4. Behavioural intention measurement

Behavioural intention was measured by the extent of visitors' willingness to participate in certain coastal conservation activities. In this study, behavioural intentions composed of thirteen 5-point Likert-type scale items (1 = "strongly disagree", 5 = "strongly agree") based on previous studies by Orams (1997) and Beaumont (2001) were used.

Considered to be a multitude of measures of behavioural intentions, these behavioural intention items were divided into three parts including travelling behaviour, specific environmental behaviour, and general environmentally responsible behaviour. The first part measured travelling behaviour with two items (e.g. "I will recommend this site to friends/relatives", "I will revisit this area"). The second part measured three specific environmental behaviours (e.g. "I will not climb the cliffs", "I will not remove any fossils from the area"). In particular, the specific environmental behaviour items were chosen from publications related to the code of conduct for fossil collecting at the Charmouth coast area and also guided by the results of the interviews with the staff at the

Charmouth Heritage Coast Visitor Centre. The third part measured eight general environmental behaviours (eg. "I will follow the code of conduct", and "I intend to make a donation to an environmental organisation").

Additionally, open-ended questions were examined to see the overall understanding by the respondent on connections between the respondent's behaviour and the tourism problems of a site. The example question was developed from Tubb (2003)'s study as "what steps might you take to ensure that you are not having a negative impact on the natural environment?"

4.5. Reliability of three subscales

Before describing the findings, some measurement properties were reviewed for reliability and validity. A reliability assessment (Cronbach's alpha) was used to check the internal consistency of each index, which is knowledge ($\alpha = 0.90$), attitudes ($\alpha = 0.69$), and behavioural intentions ($\alpha = 0.74$). The alpha coefficient for the attitude section was lower than the other sections. However, on the attitude scale, reliability analysis on the twelve items of attitudes in the measure found two items dropping out due to their low inter-item correlation. The purified ten-item scale had a Cronbach's alpha of 0.69. The results of the reliability test showed that the alpha coefficient for each scale was reasonable for a test consisting of a 200 sample size in the exploratory study (Cronbach's alpha >0.50).

5. Data analysis

The SPSS statistical package was used to analyse the data. First, descriptive statistics were generated in order to characterise the visitors' profiles including demographic, psychographic, trip

attributes and usage of interpretive programme variables. Following a descriptive profile of respondents and a factor analysis of the scale variables (e.g. motivation scale), several Chi-square analysis tests of pre- and post-visit characteristics were conducted to assess whether the survey samples had similar profiles.

As mentioned in the literature, it is important to compare a range of socio-demographic and other trip-attribute variables to identify whether or not these variables significantly influenced the effects of the visitor centre between pre- and post-exposure groups regarding the main indicators. Chi-square tests showed that no significant differences were found between samples on demographic characteristics. But there were significant differences on the following variables: motivation, previous involvement in environmental organisation or activities, previous travel experiences, and level of use of interpretive component variables between pre- and post-visit groups.

Series of MANOVA tests were also conducted to identify the interactions of the effects of the visitor characteristics and the effects of the visitor centre on dependent variables. This test explained that there were no interactions between other independent variables and the use of the visitor centre variable (pre-/post-visit samples). This indicated that it enables to examine the direct effects of the visitor centre. Next, one-way ANOVA tests were performed to identify whether there is any difference in knowledge, attitudes, and behavioural intentions between pre- and post-visit groups. Finally, for each of the independent variables a Pearson correlation coefficient of r was used to determine the relationship between the knowledge and attitude sections and behavioural intentions toward coastal conservation. Then, the independent variables were entered into stepwise multiple regression analysis to determine the strongest variable in influencing behavioural intention.

6. Results

6.1. The profile of visitors to the Charmouth coastal area

The demographic profiles of the survey samples (N=207) showed that the total number of female visitors (54,6%) was slightly higher than male visitors (45,4%). The majority age group of participants was between 36 and 45 years (41,1% of all respondents). About 35% of all participants stated they had university degrees. Visitors from Dorset accounted for 17% of respondents and 48,4% were from the South west and South east of England. 34,6% of respondents were from other regions of England and or elsewhere. Most respondents surveyed were travelling as a family including children (58,5%). Further, 61,8% of respondents indicated that they were revisiting the Charmouth coastal area. A series of Chi-square tests indicated that there were no significant differences in demographic variables and other variables between the pre-visit and post-visit samples. It means that the demographic characteristics of the survey samples had similar profiles in both the pre- and post-visit groups.

Following the demographic profile of the visitors surveyed, this study also examined the respondents' involvement in environmental organisations or activities and their experiences of trips to natural areas, as well as motivation. The results of Chi-square tests and ANOVA tests indicated that there were significant differences between pre- and post-visit groups in the psychographic profile of the survey samples. Some 36,6% of all respondents (N=207) indicated that they were involved in environmental organisations or other activities related to the environment. The result of a Chi-square test (π^2= 6.405, p=0.011) revealed that more post-visit respondents (51,5%) had involvement in environmental organisations than pre-visit respondents (28,6%).

In addition, some 40,3% of all respondents (N=207) indicated that they had visited natural

areas more than ten times on previous trips. A Chi-square test demonstrated that there were significant differences between the two samples (π^2= 11.145, p=0.004). Almost half of the post--visit group had more experience of previous trips to natural areas than the pre-visit group (27,5%).

Further, respondents were asked to rate the importance of their main reasons for visiting the Charmouth coastal area. Among four motivation domains identified by factor analysis, the most important motive domain for all respondents (N=207) was "having fun with family/friends" (mean=4.57, SD= 0.89), which was followed by "enjoying nature" (mean=4.23, SD=0.72), "learning about fossils and geology" (mean=3.33, SD=1.07) and "beach activity" (mean=2.42, SD=0.96). Additional tests using one-way ANOVA demonstrated that there were significant differences in "learning motivation" (F=10.85, p<0.001) between the two samples. "Learning" motivation was more important to the post-visit group (mean=3.55, SD=1.03) than the pre-visit group (mean=3.07, SD=1.07).

6.2. Interpretive programme experiences

The level of use of interpretive components was also examined among the two groups. The level of participation in interpretive programmes was defined in terms of the total number of interpretive programmes in which respondents had participated. The scores ranged from "low levels of participation" (0-2 media), "medium levels of participation" (3-4 media), to "high level of participation" (5-7 media). Table 1 showed that there were significant

differences between the pre- and post-visit groups in terms of levels of programme participation (p =0.000). Almost 52,4% of the pre-visit group (N=92) had not used information at all and the other half of the pre-visit sample used one or two types of interpretive programmes, which mainly relied on brochures and signboards. In contrast, approximately 48,1% of the post-visit group (N=115) undertook from three to four types of media (e.g. displays, films, or a guided walk), followed by five to seven types of interpretive components (34,3%). These results suggested that the post-visit group members were more likely to use more of the various interpretive components.

6.3. The effects of the visitor centre experience on environmental knowledge, attitudes and behavioural intentions

Overall, the effectiveness of the visitor centre regarding knowledge, attitudes, and behavioural intentions between pre- and post-visit samples were evaluated to determine if significant differences existed between the pre- and post-visit means on each of the three indicators. Overall mean scores of knowledge, attitudes and behavioural intentions were calculated on the basis of points allocated to each response. A significant difference was found between samples according to a series of t-tests and ANOVA analysis on knowledge and behavioural intentions.

Knowledge
The findings showed that the effectiveness of the visitor centre on knowledge was seen in significant

Table 1 | Comparison of use of interpretive programmes on-site between the two groups

Levels of interpretive programme participation		Pre-visit % (N=92)	Post-visit % (N=115)	Chi-square	df	Sig.
Lower levels of participation	(None)	52,4				
	(1-2 media)	44,3	17,6	125.548	2	0.000
Medium levels of participation	(3-4 media)	3,3	48,1			
Higher levels of participation	(5-7 media)	0	34,3			

differences between pre- and post-visit samples in both self-assessed knowledge and open-ended questions.

First, the self-assessed method was employed to see how visitors understand the environmental concepts related to the Charmouth coastal area. In this study, respondents were asked to indicate how much they felt they knew about the twelve items on a 5-point scale (1 = no knowledge at all and 5 = excellent knowledge), regarding several site-specific topics such as geology, fossils, conservation, and the appropriate behaviours. Overall, most of the respondents (N=207) rated that they had low levels of knowledge about the environmental issues and conservation (mean=2.42, SD=0.72). A significant difference was found between the two samples (t=-3.602, p=0.002). The post-visit group reported that they had higher levels of knowledge (mean=2.55, SD=0.69) about fossils and conservation issues than did the pre-visit group (mean=2.25, SD=0.734). Next, one-way analysis of variance test was performed to see if any significant differences existed between the pre-visit and post-visit samples on each of the twelve knowledge items. Table 2 indicated that there were significant

differences between the two groups on knowledge about fossils and conservation issues.

In addition, the recall question was used to see the connections between visitors' behaviour and the problems of a site, as cliff erosion is one of the most important issues at the Charmouth coastal area. Particularly, respondents were asked to describe the reasons for keeping away from the cliffs with open-ended questions. All post-visit respondents mentioned more than one specific reason to keep away from the cliffs while 15,2% of pre-visit group mentioned no specific reason. A significant difference was found between sample answers according to the Chi-square test of association (π^2= 19.692, p=0.000). The specific answers frequently mentioned by both groups were "landslide" (58%) and "rock falls" (47,1%). This result suggested that most of the respondents were aware of the behaviour appropriate for protecting the cliffs from being rapidly eroded by the sea or visitors to the Charmouth coastal area.

Attitudes

The study tested respondents' level of agreement/disagreement using 5 point Likert-type

Table 2 | Self-reported knowledge mean and ANOVA test between pre- and post-visit group

	Pre-visit (N=92)		Post-visit (N=115)		F	Sig.
	Mean	SD	Mean	SD		
1. Geology						
Coastal landform	1.98	1.016	2.19	0.926	2.500	0.115
Jurassic period	1.99	0.932	2.14	0.945	1.301	0.255
2. Fossils						
History of fossil collectors	1.68	0.824	1.92	0.860	4.041	0.046
Fossil collecting skills	1.71	0.832	2.13	0.913	11.954	0.001
Types of fossils	1.89	0.871	2.30	0.991	9.399	0.002
3. Marine life						
Types of fish	2.23	1.100	2.22	0.912	0.011	0.917
4. Conservation						
Biodiversity	1.95	1.093	2.18	1.126	2.134	0.146
Coastal protection	2.23	1.117	2.55	0.982	5.063	0.026
Cliff erosion	2.39	1.097	2.78	1.033	6.742	0.010
Pollution	2.73	1.259	3.19	1.099	7.973	0.005
5. Visitor management						
Coastal safety	3.08	1.207	3.34	1.042	2.872	0.092
Code of conduct	3.10	1.276	3.35	1.076	2.280	0.133

Note: used a 5-point scale from 1 (no knowledge at all) to 5 (excellent knowledge).

scale with ten environmental attitudes statements (1 = strongly disagree and 5 = strongly agree). A total mean score of ten attitude items was 3.64 (SD=0.55). No significant increases were recorded (t=1.524, p=0.129) between samples when pre-visit (mean=3.71) and post-visit levels (mean=3.59) were compared.

However, when performing one-way analysis of the variance test on the pre- and post-visit samples' answers to each of the ten attitude statements, differences were found between samples in their attitudes to two of the 10 statements. As indicated in Table 3, most of the respondents, in both pre- and post-visit groups, showed a strongly positive environmental attitude toward conservation of the site. In contrast, post-visit samples generally disagreed with the approach to fossil collecting activities. It indicated that post-visit groups have a slightly positive attitude to collecting fossils, which is allowed as long as visitors collect them from the beach. This is one of the most popular activities for tourists in this area.

Behavioural intention

The question was used to examine the degree of verbal commitment respondents had to changing their behaviour as a result of their experience with the visitor centre.

The overall mean score of thirteen behavioural intention items toward environmentally responsible behaviour was high (mean=3.72, SD=0.47) for both pre- and post-visit groups. As expected, the result of t-test analysis showed a significant difference in the overall mean scores between these two groups (t=-2.227, p=0.027), demonstrating that the post-visit group (mean=3.78, SD=0.50) appeared to be more favorable in their intentions regarding environmentally responsible behaviour than the pre--visit group (mean=3.78, SD=0.44).

Specifically, in comparisons between the two samples on each of 13 behavioural intentions items in Table 4, the respondent's intentions in both groups were less favourable on five statements including "not removing fossils", "involvement with environmental issues" "donation", "volunteer work"and "membership of friends of Charmouth Heritage Coast Centre".

In addition, when asked about their intentions to act to reduce their negative impact on the environment, results of recall types of question supported the findings of self-rating behavioural intentions. Almost 76 % of the respondents (N=207) mentioned they had intentions toward general environmentally responsible behaviour. The Chi--square test revealed that there were significant differences between pre-visit and post-visit samples

Table 3 | Mean scores and ANOVA test for attitudes between pre- and post-visit group

	Pre-visit (N=92)		Post-visit (N=115)		F	Sig.
	Mean	**SD**	**Mean**	**SD**		
− Protection of nature						
It is important to protect the Jurassic Coastal Area	4.63	0.794	4.80	0.533	3.353	0.081
It is important for visitors to follow a code of conduct	4.58	0.771	4.58	0.759	0.004	0.947
Cliff erosion should be kept to a minimum	4.46	0.941	4.23	1.109	2.599	0.108
− Concerns about pollution						
Marine life is in danger	3.49	1.010	3.47	1.102	0.39	0.844
Pollution on the coast is increasing	3.76	1.152	4.02	1.043	2.818	0.095
There is too much litter on the beach	3.63	1.135	3.61	1.190	0.012	0.914
− Tourism impacts						
Visitors create problems in the coastal area	3.22	1.078	3.18	1.136	0.50	0.823
The coast is too crowded	2.98	1.058	2.84	1.048	0.849	0.358
− Fossil collecting						
Collecting fossils damages the environment	3.10	1.149	2.68	1.126	6.756	0.010
Visitors should not collect fossils	3.24	1.217	2.52	1.340	15.805	0.000

Note: used a 5-point scale from 1 (strongly disagree) to 5 (strongly agree).

Table 4 | Self rated behavioural intentions mean and ANOVA test between pre- and post-visit

	Pre-visit (N=92)		Post-visit (N=115)		F	Sig.
	Mean	SD	Mean	SD		
I will recommend a visit here to friends/relatives	4.14	0.956	4.52	0.787	9.856	0.002
I will revisit here	4.29	0.908	4.37	0.941	0.385	0.536
I do not intend to disturb any marine life	4.51	0.920	4.52	0.892	0.007	0.932
I intend to behave in a way that will not harm the environment	4.74	0.511	4.77	0.667	0.096	0.757
I will follow the code of conduct	4.53	0.733	4.77	0.563	7.176	0.008
I will not remove any fossils from the area	3.39	1.460	2.59	1.369	16.448	0.000
If I discover a special fossil, I will inform Charmouth Heritage Coast Centre	4.39	1.027	4.40	1.041	0.004	0.952
I will not climb cliffs	4.64	0.846	4.70	0.786	0.228	0.633
I will remove beach litter	4.52	0.908	4.44	0.881	0.393	0.531
I intend to becomes more involved in environmental issues	2.80	1.303	3.06	1.045	2.471	0.118
I intend to make a donation to an environmental organisation	2.26	1.166	3.08	1.171	24.999	0.000
I intend to become involved in volunteer work for environmental conservation activities	1.59	0.891	2.15	1.086	15.939	0.000
I intend to become a member of the friends of Charmouth Heritage Coast Centre	1.45	0.761	1.77	0.974	7.019	0.009

Note: used a 5-point scale from 1 (strongly disagree) to 5 (strongly agree); df=205.

(π^2= 17.764, p=0.000). Overall, 23,5% of the post-visit group members mentioned more than three types of actions compared to the number of actions mentioned by members of the pre-visit group (4,3%).

Further, the appropriate behaviour most mentioned by all respondents was "do not leave litter" (35,2%), followed by "keep to footpaths" (19,7%), and "follow the code of conduct" (11,4%). Interestingly, post-visit samples mentioned more specific actions (22,7%) related to cliff erosion and fossils collecting skills such as "do not climb the cliffs", or "do not hack at the cliff face to collect the fossils". In contrast, only 4,8 % of the pre-visit group mentioned "do not climb the cliffs".

6.4. Relations between knowledge, attitude, and behavioural intention

The second objective of this study investigated how the independent variables (knowledge and attitudes) were related to behavioural intentions as a result of the experience of the visitor centre. In order to identify the most influential factors in behavioural intentions, multiple regression analysis

can help to understand the linear relationship of knowledge, attitudes and behavioural intentions. A series of stepwise multiple regression was conducted to test the two main hypotheses at this second stage. This was necessary to identify those variables that contribute most to the total variance explained for behavioural intention.

For the first hypothesis test, the relationships between knowledge, attitudes and behavioural intentions were examined, and the results of Pearson's correlation coefficient were measured regarding behavioural intentions and their correlation with knowledge and attitudes (Hypothesis 1). As expected, attitudes (r=0.456, p=0.000) were significantly correlated with behavioural intentions, more so than knowledge (r=0.212, p=0.002). It indicated that attitudes might be the stronger factor in influencing behavioural intentions, even though there were no significant differences on overall attitudes between pre- and post-visit samples from the results of the series of ANOVA tests.

In addition, this finding may suggest some kind of linear relationship exists between overall behavioural intentions and knowledge, and overall behavioural intentions and attitudes. For the next step, stepwise multiple regressions were used to

determine the influential predictors on behavioural intentions. The sum scores of variables on each of the items for knowledge and attitudes were utilised as the independent variables in the regression analysis. The scatter plots and the Pearson correlation coefficients r showed that there was a linear relationship between the independent variables and the dependent variable (overall behavioural intentions). It was ensured that the independent variables were not highly correlated with each other.

All of the relationships examined between knowledge, attitudes and behavioural intention were positive, linear, and significant at the 0.05 level or greater. The results showed that attitudes (β=0.441, p<0.000) and knowledge (β=0.212, p<0.001) were predictors of behavioural intentions (adjusted R square=0.231, p<0.000). Findings imply that as attitudes and knowledge of the environmental issues increase, there is a simultaneous increase in their behavioural intention toward coastal conservation. However, there were no link between knowledge and attitudes.

6.5. The relative contributions of independent factors to behavioural intention

For the second hypothesis test, this study also investigated the relative contributions of various factors to visitors' behavioural intentions toward responsible behaviour for conservation at the Chrarmouth coastal area. A series of multiple stepwise regression equations (MR) were performed to determine the ability of attitudes and knowledge data as well as individual factors in influencing environmental behavioural intentions (Hypothesis 2). As mentioned through literature review, the visitor centre experiences cannot be regarded as the sole factor affecting knowledge, attitudes or behavioural intentions.

As seen in Table 5, a variety of 14 independent variables were considered including demographic (age, gender, residence, education), trip attributes (environmental involvement, and previous trip experiences to the natural area), interpretation participation (visitor centre participation and level of use of interpretive programmes), four factors of motivation (learning, having fun with family, beach activities and enjoying nature), knowledge, and attitudes.

Overall, eight independent variables were correlated to behavioural intentions and then all were added to the multiple regression analysis including attitude and knowledge factors. When eight independent variables were added to the regression model of behavioural intentions, six independent variables were related to behavioural intentions accounting for 36% of a total of variance. Surprisingly, the knowledge factor had no contribution to the model, although the knowledge factor was positively correlated with behavioural intention. Again, attitude variables (β=0.389) were the most important contributor to influencing behavioural intentions, followed by the "enjoying nature" motivation (β=0.201), the level of interpretation

Table 5 | Best predictors of all variables on overall behavioural intention

N=196	Behavioural intention		
	r (Sig.)	Beta	t (Sig.)
Attitudes	0.469 (0.000)	0.389	6.325 (0.000)
Enjoying nature	0.345 (0.000)	0.201	3.344 (0.001)
Level of interpretation participation	0.174 (0.007)	0.171	2.844 (0.005)
Gender	0.253 (0.000)	0.169	2.883 (0.004)
Environmental involvement	0.259 (0.000)	0.124	2.073 (0.04)
Age	0.209 (0.002)	0.122	2.072 (0.04)

Note: adjusted R square= 0.362, F=19.464, p=0.000.

Table 6 | Best predictors of all variables on overall behavioural intention between pre-visit and post-visit sample

Pre-visit (N=89)	Behavioural intention			Post-visit (N=107)	Behavioural intention		
	r (Sig.)	Beta	t (Sig.)		r (Sig.)	Beta	t (Sig.)
Attitudes	0.490 (0.000)	0.392	4.184 (0.000)	Attitudes	0.495 (0.000)	0.429	5.201 (0.000)
Enjoying nature	0.347 (0.000)	0.228	2.471 (0.015)	Enjoying nature	0.313 (0.000)	0.206	2.531 (0.013)
Environmental involvement	0.283 (0.004)	0.205	2.269 (0.026)	Gender	0.291 (0.001)	0.191	2.324 (0.022)
				Level of interpretation use	0.164 (0.04)	0.145	2.002 (0.047)
Adjusted R square= 0.306; F=13.904, p=0.000				Adjusted R square= 0.333; F=14.365, p=0.000			

participation (β=0.171), gender (β=0.169), previous involvement in environmental organisations or activities (β=0.124), and age (β=0.122). With regard to gender and age, female and older groups (over 46) had higher levels of positive intentions towards conservation behaviour than males (and younger groups). Also, visitors who had already been involved in environmental organisations were likely to have favourable willingness to act responsibly for conservation.

Further, this regress analysis model was compared to identify if any differences existed between the two groups (see Table 6). Different visitor factors were found between the groups. Pro-environmental behavioural intentions in the post-visit groups were related to gender (female > male) and level of interpretation use while the pre-visit group's intentions were influenced by existing pro-environmental involvement. Attitudes and a motivation toward enjoying nature were the important factors in the intentions for both groups.

7. Discussion

7.1. The effectiveness of the visitor centre on knowledge, attitude, and behavioural intention toward conservation at the Charmouth coastal area

The primary purpose of this study was to determine the effectiveness of interpretation in promoting the antecedents of responsible environmental behaviour for conservation. The three main indicators were selected including knowledge of the environmental issues, attitudes of conservation and tourism impacts, and behavioural intentions toward responsible environmental behaviour. This study revealed that interpretation within the Charmouth Heritage Coast Visitor Centre did make a positive contribution to the management of visitors to the Charmouth coastal area. The findings of this study provided the insights regarding the relative influences of the key influential factors on responsible behaviour.

Knowledge

The findings of overall increases in self-rated knowledge and the open-ended questions indicated that interpretation within the Charmouth Heritage Coast Visitor Centre was found to be effective in increasing visitors' knowledge and awareness about the specific environmental issues of the site and specific appropriate behaviour. Firstly, the results of self-rating knowledge showed significant differences between pre- and post-visit samples in their knowledge of "fossil" and "conservation" issues including pollution by beach litter and cliff erosion at the Charmouth coastal area. This corresponds with the findings of several studies that interpretation can be effective in increasing visitors' environmental knowledge of the issues of the site (Tubb, 2003; Moscardo *et al.*, 1997; Orams 1997; Madin and Fenton, 2004).

Overall, both pre- and post-visit respondents had higher levels of knowledge about the appropriate behaviour for coastal conservation and safety

compared to other concepts including fossils and conservation issues. In particular, even though there were no significant differences between the two groups in the results of the self-rating knowledge scale on appropriate behaviour, the findings of open-ended questions supported the view that respondents who had experienced the visitor centre had more specific knowledge of the issues and action skills related to the protection of cliff erosion and responsible fossil collecting. It suggested that the knowledge gained from the centre would remain embedded in the structures of the existing knowledge of visitors. This finding is similar to the study of Tubb (2003) who found that more post-visit respondents who had experienced the visitor centre were able to mention the specific actions for protecting the Dartmoor National Park. According to Tubb (2003), recall questions showed that visitors were able to use the knowledge of the centre to predict the likely consequences of their actions in the future, and could see connections between their behaviour and the problems of the site.

It was also assumed that their increased knowledge of the specific actions will help modify their inappropriate behaviour. This study revealed the assumption that knowledge of a problem is clearly a prerequisite for behavioural modification (Newhouse, 1990). It is worth looking at the regression data to explain this assumption. This study indicated that environmental knowledge of the visitors as resulting from the visitor centre experiences had a small positive effect on responsible behavioural intentions. The result is consistent with the findings of other researchers (e.g. Borden and Schettino, 1979; Cottrell and Graefe, 1997; Hwang *et al.*, 2000). As several researchers indicated, this finding suggests that interpretation cannot force people to change their behaviour, in order to prompt behaviour change, interpreters or educators need to convince tourists of the reasons why they should change and what they can do to help (Orams, 1996; Newhouse, 1990).

Attitude

Questionnaire results indicated that interpretation within the Charmouth Heritage Coast Centre had not changed overall attitudes toward coastal conservation and tourism impacts, but there were significant differences in parts of attitudes towards specific issues related to fossil collecting activities. This corresponds with the findings of Tubb (2003) that interpretation within the High Moorland Visitor Centre was effective on only an attitude related to the feeding of wildlife, while there were no significant effects on overall attitudes. These findings tend to indicate that the interpretive programme was not having the desired outcome of promoting pro-environment attitudes. A researcher suggested that it would be difficult to change deeply ingrained attitudes through a single interpretation experience (Beaumont, 2001). Instead, it seems likely that most environmental attitudes are formed as a result of life experiences (Newhouse, 1990).

However, the reasons for the limited change in attitude can be found in the way of measuring attitudes. This difficulty of measuring respondents' attitudes toward the environmental issues would be explained by several influencing factors. Firstly, this result may be due to a "ceiling effect" in that both pre- and post-visit groups already had reasonably strong pro-environmental attitudes as a result of life experiences (Newhouse, 1990; Beaumont, 2001). The findings of this study revealed that most respondents in both pre- and post-visit groups, showed a strongly positive environmental attitude toward the protection of the coastal area. As Beaumont (2001) reviewed, people who enter programmes with already strong pro-environment attitudes do not intensify those attitudes significantly as result of interpretation participation, and therefore visitor characteristics can be the influencing factors, diminishing the effects of the visitor centre on attitude change. Further, Orams (1997) also indicated that a failure to increase attitudes by interpretation may be by social desirability influence. That is, as environmental issues

have been widely discussed, most respondents would know the "desirable" answer to a question about environmental attitudes.

Finally, the validity of the attitude statements can be one of influencing factors to create the unclear results of attitude change in this study. There were indications that the interpretive programmes at the Charmouth visitor centre influenced attitudes toward the specific issues related to fossil collecting. Statistical analysis showed that most pre-exposure respondents considered "fossil collecting" as a negative activity which harms the environment and that they supported the view that "visitors should not collect the fossils at this site". In contrast, the post-exposure respondents who had experienced the visitor centre positively supported fossil collecting activities as one of the main attractions in promoting tourism in the Charmouth coastal area. The interpretive programme's messages at the site emphasised where visitors can collect fossils in promoting "sustainable geotourism" and provided information about the negative consequences of collecting fossils from the cliffs. In this area, collecting fossils on the cliff was not allowed for visitors because of cliff erosion problems, although visitors are allowed to collect fossils on the beach and this is one of the most important attractions of the site (referred to the code of conduct for fossil collecting brochure). As there are both positive and negative consequences regarding fossil collecting activities, the attitude statements regarding fossil collecting activities need to be more specified. This is in agreement with a previous argument that more specific attitudes about specific acts will influence feelings of personal responsibility toward an action and verbal commitment to an issue or problem resolution (Cottrell, 2003; Fishbein and Ajzen, 1975).

Despite the failure to identify overall changed attitudes towards conservation issues and tourism impacts, the results of the regression analysis demonstrated that attitude was the most important factor in promoting behavioural intentions for coastal conservation in both pre- and post-visit samples. This finding supported the assumptions that attitude is considered as the most influential predictor to behavioural intention (Fishbein and Ajzen, 1975; Hines *et al.*, 1986/87; Newhouse, 1990). However, it was found that there was no link between knowledge and attitudes. It means that increased knowledge does not immediately lead to changed favourable attitudes towards environmental conservation. Indicating the failure of the linear link between knowledge and attitude, it is suggested that it is critical that interpretation provide an opportunity for affective response and not merely knowledge (Iozzi, 1989).

These findings provide interpreters with important implications for the future. Obviously, attitude analysis can and should be evaluated in developing the design of an effective interpretation strategy for the behavioural change purpose. In particular, attitudes toward protection of the environment should not be ignored in the development of an interpretation plan strategy. Furthermore, several researchers pointed out that interpretation that focuses on the management of environmental problems will be most successful when it emphasises local problems and specific inappropriate behaviour (Dimopoulos and Pantis, 2003). Therefore, the findings of this study recommended that interpreters need to strengthen the specific attitudes toward performing the problem behaviour, which could be very important in increasing responsible environmental behaviour.

Behavioural intention

On the whole, interpretation was effective in facilitating pro-environmental behavioural intentions as a result of the visitors' experiences at the visitor centre. The finding showed that the post-visit group respondents had higher levels of positive environmental behavioural intentions including "recommendation to friends", "not removing the

fossils", "following the code of conduct", and other environmentally friendly involvement (e.g. donation, volunteer work, and membership of an environmental organisation) compared to the pre-visit respondents. This implies that visitors' interpretive experiences of the visitor centre reinforced their intentions to engage in environmental activities. This result accorded with the findings of Moscardo *et al.* (1997) that the Skyrail interpretation programmes experience had positively influenced visitors' intentions to engage in rainforest activities. Similarly, Beaumont (2001) also supported the view that people who were more environmentally aware and conscious and those who had learnt more than others during their visit were the most likely to have been influenced regarding behaviour change in the longer term.

In particular, the Charmouth Heritage Coast Visitor Centre reinforced visitors' motivation to act in an appropriate way in engaging in collecting fossils activities through increased knowledge of the problems and action skills and favourable attitudes toward fossil collecting activities. That is, interpretation might help the visitors by providing them with the knowledge skills regarding the specific issues and in turn, it might help the visitors to behave in an appropriate way for the local environmental conservation. In the context of Fishbein's theory of reasoned action, if attitudes and knowledge measurement focus on the specific issues, this will lead to a change in behaviour in desirable directions. This causal link between knowledge, attitudes and behavioural intention was investigated by the multiple regression analysis. The results of the regression analysis revealed the assumptions that both attitudes and knowledge were correlated with behavioural intentions, but that attitudes were the stronger factors to intentions while knowledge was a moderate predictor. This reflects Oram's (1996) model that environmental education programmes or interpretation concentrated on both the affective and cognitive domains would be more effective in promoting responsible behaviour and managing the visitor's negative impacts on the environment.

7.2. The influences of visitor factors on behavioural intention

It was argued that attitudes and behaviour change will not occur only through an increase in knowledge and experience of the interpretive programmes, but also through numerous intervening factors related to both the individual and their previous experiences. Therefore, it is important to identify whether or not these visitor variables significantly influenced the effects of the visitor centre regarding pre- and post-exposure groups on behaviour change. Based on this assumption, this finding reviewed that behavioural change can be influenced by both an individual's psychographic factors and their interpretation or environmental experiences. In order to examine the most influential factors in behavioural intention in this study, it was found that significant factors regarding visitor characteristics included visitors' motivation to "enjoy nature", levels of interpretation participation, pre-existing involvement in environmental organisations or activities, gender, and age.

This supported the view of Beaumont (2001) that the majority of visitors to natural areas who are interested in the environment and are motivated to enjoy nature, are likely to participate in the interpretive programmes and already hold strongly pro-environmental attitudes. Therefore, the effect of interpretation will not be successful in significantly changing pre-existing favourable attitudes toward the environment due to a "ceiling effect" (Beckmann, 1991). This view corresponds with the findings of this study that post-visit groups were likely to be involved in environmental organisations or activities and be motivated to learn about nature or fossils during their visit to the Charmouth coastal area, compared to pre-visit groups. Although post-visit respondents had higher levels of behavioural intention than pre--visit groups, the level of interpretive experience of the post-visit respondents was still an influential factor in changing behavioural intention. In contrast, it was found that positive behavioural intentions of

pre-visit groups are positively influenced by their pre-existing environmental involvement rather than by level of interpretation participation.

This finding supported the view of Archer and Wearing (2003) that continued involvement in interpretation or natural experiences can lead to a strengthening of environmental attitudes, value, and awareness. Therefore, it is suggested that identifying and understanding visitors' pre-existing pro-environmental attitudes and demographic factors, especially age and gender can be important intervening variables in evaluating and developing effective interpretation for environmental behavioural modification.

As mentioned by Beaumont (2001), visitors to natural areas who participate in ecotours or interpretive programmes are already interested and involved in the natural environment, and already hold strongly pro-environmental attitudes toward responsible environmental behaviour. Therefore, this study also supported the view that visitors' experiences and motivation could be considered as the most important factors in predicting responsible behaviour. These visitor factors can also diminish the effects of the visitor centre on behaviour change due to a "ceiling effect" (Beaumont, 2001).

8. Conclusion

On the whole, the results of the study provided valuable empirical evidence that interpretation can play an important role as a visitor management tool in minimising negative impacts on the environment and promoting the appropriate behaviour for conservation in the case study of the Charmouth heritage coastal area. This study also supported previous assumptions that interpretation can help to enhance visitors' awareness and concern of the environmental issues and specific action skills which will influence individuals to be more environmentally motivated in engaging in environmentally responsible

behaviour. Subsequently, visitors will modify their inappropriate behaviour in the future (Cooper *et al*., 1998; Orams and Hill, 1998; Kuo, 2002). Therefore, the management benefits of interpretation can contribute to successful visitor management and achieving the conservation goals of sustainable tourism development (Kuo, 2002; Tubb, 2003).

Another important lesson to be learnt from this study is that visitor behaviour change by interpretive experience is a difficult and complex process which involves numerous intervening factors. They can be related to the interpretive programme itself and the individual's traits, as well as the ways in which knowledge and attitudes were measured and how they are related to behaviour (Beaumont, 2001; Orams, 1996; Hines *et al*., 1986/87). As expected, the finding supported the notion that environmental behavioural intentions were influenced by the relative contribution of several variables. In particular, it was found that attitudes were a stronger influential factor in promoting behavioural intentions than knowledge. It revealed that knowledge, if it was measured targeting the environmental issues and responsible behaviour, was also correlated with behavioural intentions in this study. The significance of the contribution of visitors' characteristics to behavioural intentions was identified including motivation to enjoy nature, pre-existing environmental involvement, and level of interpretation participation. These findings indicate that the effects of interpretation could vary according to the relative contribution of the visitor and interpretation.

Therefore, in order to promote environmental behavioural change through effective interpretation, it is suggested that there is a need to approach based on a more integrative and extended framework which incorporate the major antecedent variables such as knowledge and attitudes along with both visitor characteristics and interpretation techniques. Despite its stimulating results, the present study also has several limitations. First, it identified only three antecedents of responsible environmental

behaviour to explore the causal relationships. As researchers considered that situation factors might cause the gap between behavioural intentions and actual behaviour (Hines *et al.*, 1986/87), there would be the limitation that an individual's intentions to behave in a particular manner might not lead to the actual behaviour automatically (Kuo, 2002). Future research requires examination of the actual behaviour.

Second, the low reliability of the attitude items in this study can be considered as another limitation. Specifically, attitude measurement needs to consider "social desirability". Future study should pay more attention to increasing the reliability of the attitude measurement.

Nevertheless, the findings of this study provide an insight into understanding the complex process of the interpretive experience and its relationship to behavioural modification. This empirical evidence emphasises that the successful management role of interpretation can contribute to achieving the goals of sustainable tourism and conservation of the environment in sites where resources are sensitive. The on-going evaluation and feedback of the effectiveness of interpretation on attitude and behaviour change should be continued to design and develop appropriate educational interventions and should be also an integral part of the sustainable tourism development plan.

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