

Community-led Coastal Planning: The Contribution of Visualizations to Decision-making

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Abstract: A number of communities along the eastern coast of the UK are experiencing change to their physical and social landscapes. This creates the need for opportunities to consider and address issues specific to the communities. This paper reports on research with a community in a village in North Norfolk (UK) and examines the use of visualizations as aids in bottom-up decision making. Visualisations created through geodesign represent suggestions from study participants about what the village could contain and look like with a view to making it a viable place for people to live in the future. These visualisations, as part of an iterative ongoing process of community involvement, served as a basis for visioning futures of the village by facilitating understanding of changes and possibilities within the village. They are also used as a tool to illustrate possible challenges and opportunities for the village to adapt to coastal change.

Keywords: Geodesign, visualizations, decision-making, coastal change, participation, engagement, North Norfolk

1 Introduction

In the East Anglian region of the UK, the North Norfolk coast is a constantly changing and diverse stretch of coastline; parts of this coast are affected by erosion of unconsolidated cliff material at rates of about 1 m per year (DAWSON et al. 2015). Coastal communities in this area are faced with the challenge of understanding, and adapting to their changing landscape. The Shoreline Management Plan for the eastern portion of the north Norfolk coast endorses the importance of stakeholder engagement and encourages this in developing policy options (SMP 2012). However, the SMP and other policies are, in some cases, perceived to limit the number of options available, and some have been met by distrust (O'RIORDAN et al. 2014). To address issues of accessibility, trust, and transparency in environmental management processes there has been a movement in recent years to include communities in decision making and promote stakeholder engagement in adaptation planning, whilst acknowledging limitations of these approaches (MURO 2012, FEW et al. 2007, SHEPPARD 2012).

Visualizations have been used in landscape planning to engage individuals and groups, and aid in decision making (O'RIORDAN et al. 1993, WISSEN et al. 2008, LIESKE et al. 2009). Geodesign is the process of creating and modifying existing physical spaces (MILLER 2012). In this context, visualizations are the visual representations of these physical spaces through geodesign in order to facilitate interpretation (BROWN et al. 2006). In particular, it has been argued that the tailoring of the messages conveyed through the visualizations can lead to greater understanding and engagement (HINE et al. 2014).

This paper focuses on research conducted at a case study location in north Norfolk, generating visualizations that are representative of the concerns, needs, preferences, and character of the study participants at this location. It outlines the case study area, the methods used to

create visualisations, and discussion of these with participants. It draws lessons about the work and directions for further research.

2 Case Study: Trimingham

The village of Trimingham, the case study site in this research, is situated on the top of some of the highest cliffs in Norfolk (60m) (Fig. 1). Its current population is just under 500 people and the village has a very long history: the earliest records of birth, death, and marriages in the village date back to 1691 (BRADLEY 2018). The cliffs are made of soft glacial till and have been a cause for concern in the village historically and presently.

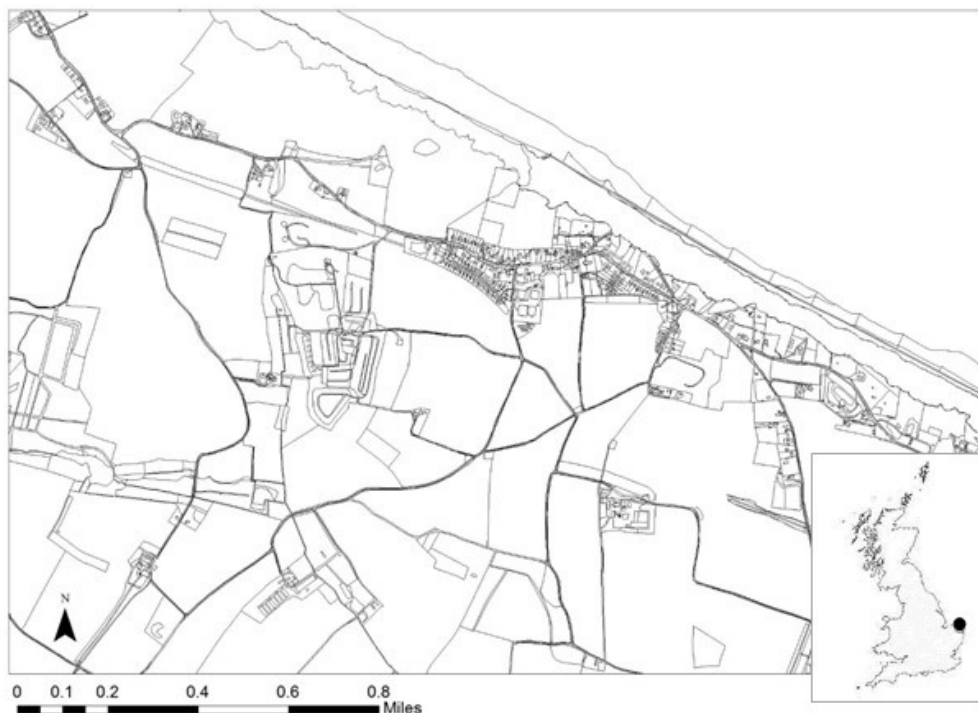


Fig. 1: 2015 Ordnance Survey MasterMap of Trimingham in Norfolk. Inset map of the UK with the North Norfolk coast indicated by the dot.

Historically there have been sea defences constructed to slow down the rate of erosion of the cliffs, but the 2012 SMP for the area noted that the stretch of coast that included the village was important in supplying sediment to other areas down-current. The area used to have a policy of ‘hold the line’, but this was changed to ‘no active intervention’ in the 2012 SMP, meaning that no further action will be taken to maintain sea defences and slow down erosion (SMP 2012).

Furthermore, the village is a Site of Special Scientific Interest (SSSI) within an Area of Outstanding Natural Beauty (AONB).

The village recently received money from the UK Lottery Fund to build a new village hall to replace the Pilgrim Shelter, a historic building that acts as the village hall and social event centre for the village. The Pilgrim Shelter is on the cliff side of the main coast road and is sitting close to the cliff edge. The new village hall is expected to be completed by March 2018.

The purpose of this study is to assess the role that visualizations play in the decision-making process through the engagement of a coastal community in visioning their future. This study used an iterative process in the creation of visualizations. It aims to better understand adaptation to coastal change and how visualizations can be used in these processes.

3 Study Phases

Visualization research tends to engage with groups of stakeholders on only one or a few occasions within a short time period (O'RIORDAN 1993, BISHOP 2013). It has been suggested that other more iterative processes over longer periods of time with the same group or a diversity of participants may also be combined with uses of visualisations, although there are advantages and disadvantages to these approaches (BISHOP 2013). There is also a debate on the benefits and limitations of engagement with stakeholders and communities using visualisations in a laboratory setting or in a more natural work setting (e. g. ELLIS & DIX 2006). The research reported in this paper applies an iterative methodology to provide participants various opportunities to contribute reflections on the changes to their village and creation of visualizations, applying an approach that is viable in a real-world situation.

Table 1 outlines the five different phases of data collection in the study. Each phase of data collection informed subsequent ones. In a review of 65 papers, ELLIS & DIX (2006) commended a study that used an iterative process where one phase of the study informed the next phase. It is argued that the inclusion of communities in this type of process leads to the facilitation of group learning, consensus building, gives ownership to the participants (LIESKE et al. 2009), and greater endorsement of future decisions made based on their participation (WHITE et al. 2010).

The first phase of exploratory interviews was used to inform the research on what participants were concerned about and what they found important in both their physical and social landscapes. They were also used as a way to learn more about the character of the village and the participants, and to better understand the social structures in the village. Following the exploratory interviews, focus groups were organized where participants were given the opportunity to discuss their concerns and opinions on coastal change and what can be done in the village to deal with future changes. They were also asked what goals they would like to achieve through the research and what role they believed the research could play for the village and any role visualisations may have in this process. Participants also gave suggestions on what they would like to see visualized. These informed the village-wide survey aimed at understanding views on coastal change, barriers to future change and engagement, as well as visualizations. These three phases informed the organization of workshops.

Table 1: Phases of data collection

Data collection phase	Dates	Details	Comments
1	August – October 2016	In depth exploratory interviews: 18 participants	Exploratory interviews were conducted to gather general views and feelings about coastal and future change in the village, and understand historical change and current management options.
2	November 2016	Focus groups: 10 participants	Focus groups were held to discuss views and concerns. These focus groups also contributed to learning more about the social character of the village and how this could relate to the study.
3	January – February 2017	Community wide survey: 66 respondents out of 168 distributed surveys	In this survey of the households in the village, the feelings about change and respondents' views on affecting change were gauged.
4	May 2017	Workshops: 11 participants	These workshops shared with participants the visualizations created by the researcher (Fig. 2a-2e). These allowed the participants to discuss and reflect on their preferences for future change and suggest changes to the visualisations. One interview was held in July with a participant who could not make the workshops.
5	November 2017	Exhibition: 13 participants	Visualisations generated based on the suggestions provided by the workshop participants, alongside discussions about future options for the village were exhibited at the Pilgrim Shelter.

This paper focuses primarily on the three workshops conducted in May 2017, and the process of creating the final visualizations based on this phase of data collection. In these workshops participants were shown visualizations, given the opportunity to vision the future of the village, and to discuss their views in a group with the aim of creating future representations of the village.

3.1 Choice of Visualization Media for the Workshops

During phases 1-3, participants mentioned that they would like to see past, present, and future visualizations of the village. They suggested that the visualizations would be useful in understanding how the coast has changed and will change in the future and could possibly be used to encourage others to be more engaged in discussing the issue of coastal change. Due to lack of strong phone signal and high-speed internet in the village, it was decided that for the purpose of this study, any further visualizations would be provided on existing mobile facilities (e. g. laptop) facilitated by the researcher (first author). Edits would be made to these, in discussion with participants, in real time. It also became evident from these phases of the research that participation from some villagers in these events was limited due to caring, time and work commitments, and familial commitments.

In response to feedback and input from participants in phases 1-3, a 1915 historic map and a 2015 OS MasterMap layer were used to create a StoryMap on ESRI Online. The StoryMap was formatted to show both maps side-by-side, with a middle sliding bar that could be moved to show a greater extent of either map to indicate differences. Based on input and suggestions from participants in phases 1-3, visualisations of the village as currently were created; these focused on the physical locations in the village that were identified as important to participants. These visualizations were shown to the participants at the beginning of each workshop on a computer projection. The visualisations were presented as still images depicting important physical features in the village from the air. This was done for practical (stills are less computer intensive than moving images) and methodological reasons (stills were able to present the suggested changes from previous phases of data collection). The purpose of the workshops was to use and refine the visualizations with research participants; visuals of how the village and surroundings are at present were discussed and modified in a coproduction process, with participants, to consider future changes and options.

Visual Nature Studio (VNS) 3, was chosen to create the visuals used in the workshops due to the ease of building and modifying landscapes through the use of the ecosystems, 3D models, and terrains that are included with the program. Ordnance Survey (OS) 2015 MasterMap was used, as well as an Environment Agency (EA) 2m Digital Terrain Model (DTM) were used, as a base to build the landscape of the village in VNS. ESRI ArcGIS 10.3 was used to create polygon and point files for use in VNS. Using these different computer programs, 3D still images were produced of the village and landscape at present (Figs. 2a-2e).

3.2 Workshop Methodology and Design

Participants from the focus groups were all invited to take part in workshops (phase 4) and grouped based on their views on future development in the village, e. g. participants who were strongly against development, strongly for development, and participants who had moderate views about development. The design of the workshops was based on the generic components of risk management outlined in RENN (2008, p.177): option generation, option assessment, option evaluation and selection, option implementation, and monitoring and feedback. The workshops focussed on the first three components (described in detail below) as the latter two could not be undertaken as part of this exercise.

At the beginning and end of each workshop, participants were asked to complete a short survey (these are termed 'pre-survey' and 'post-survey'). The pre- and post-surveys aimed to elicit how participants felt about coastal change and potential options for future change that were identified in earlier stages of data collection. The workshop post-surveys included questions aimed at understanding how useful the participants felt the visualizations were in aiding the discussion, and how effective these visualizations were based on the five measures of effective visualizations including: clarity, engagement, connectivity, trust, and feasibility (SHEPPARD 2012). The suggestions made in BISHOP (2013) inspired the use of mixed methods, and pre- and post-data collection to understand the effectiveness of visualizations. Eleven villagers attended the workshop, although two had to leave before the conclusion of the session.

The option generation activities in the workshop began with the participants being shown the StoryMap visualization. Following a short discussion about the two maps, participants then were asked to draw the future changes they would like to happen in the village on an A4 map

of the village. They were prompted to think of changes that would make the village a viable place to live in the future and then each participant had the opportunity to explain what they drew and why they drew it. While the participants discussed what changes they drew, each future option was grouped into a theme by the researcher; the participants were then asked to comment on these and reach an agreement on them.

The participants were then given three stickers, and asked to rank each theme in terms of importance for the future of the village. They were asked to put the stickers on the themes they felt were most important to discuss for the future of the village. It was explained to the participants that for the sake of time only the top three themes would be discussed further, and if there was extra time or if they chose to stay past the designated time for the workshop, other themes could be discussed as well.

The specific suggestions within the top three themes were discussed and then ranked in the same way the themes were based on what participants felt was most beneficial for the village to remain a viable place to live. There were differences in what people thought was most important for the future of the village, but the disagreements did not lead to arguments or major conflicts (see findings section below). The participants understood the process and accepted that the options that were ranked highest overall would be visualized. The participants were shown the VNS representations of the current village, through 3D still images (Figs. 2a-2e), after they ranked the top three options for future change. The visualizations included different camera angles showing important physical locations in the village that participants had previously mentioned during phases 1-3. The workshop facilitator used the pre-made visuals (Figs 2a-2e) to visualize the top three options, based on input from participants in discussion (see section 3.2 below and Figs. 2f-2h). The options were then evaluated through discussion after the participants saw the modified landscapes. The final options that would be used in the next phase of data collection were selected through participant agreement of the visualizations and the options being visualized.



Fig. 2a: Aerial view of Trimingham



Fig. 2b: Aerial view of Trimingham focusing on Broadwood Close and Middle street.

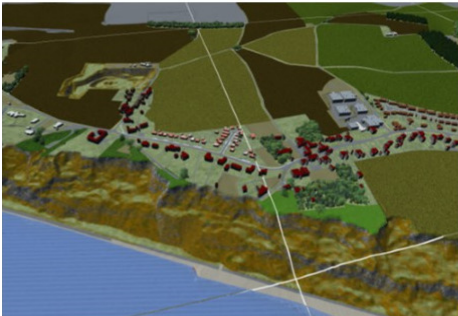


Fig. 2c: Aerial view of Trimingham focusing on the area near the Pilgrim Shelter showing the cliffs.



Fig. 2d: Aerial view of Trimingham focusing on Staden Park side of the village.



Fig. 2e: Aerial view of Trimingham focusing on the location of the new village hall. It shows a 3D model of the village hall.



Fig. 2f: Modified aerial view of new village hall.

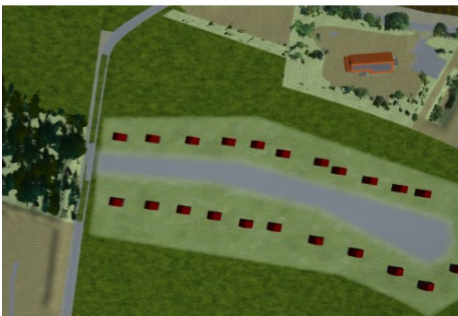


Fig. 2g: Modified aerial view of 25 new houses behind the new village hall



Fig. 2h: Modified aerial view of an estate scenario with 50 new houses.

3.3 Preliminary Findings

The workshops were transcribed and coded, and the pre-and post- survey responses were analysed. Themes that had emerged in previous phases of research were used as a starting point for the content analysis. The workshop participants indicated in their post-surveys that they felt that the visualizations were helpful in focusing the discussion, and met the five criteria for an effective visualization, by helping participants to consider and view future change in a more positive manner. Those participants that had very strong and clear views about what would be most beneficial for the village in the future indicated in the post-survey that their views and feelings about coastal change had not changed following the workshops. However, those participants with more moderate views about future change seemed to review their perspectives during the discussions, in that they modified their views on what to visualize as the visualisations were being discussed and edited by the workshop facilitator/researcher. As one of the participants stated during the workshop about the visualisations that were being co-produced, and their purpose:

TV01: “It did make us think of what the people in planning and so on or people in government were likely to accept and what they weren’t.”

In all of the workshops, participants mentioned the lack of community support and engagement when discussing a change of future for the benefit of the village. There is somewhat of a discrepancy between the reasons that people gave for not participating and the reasons people believe others are not participating. The issue of not engaging the wider community could lead to future barriers if the wider community does not agree with the options generated during the workshops.

Among workshops, there was overlap of the themes and options suggested by participants pertaining to what would help the village be a viable place to live in the future. However, options and themes in the workshops were not ranked the same in every workshop. All the workshops suggested measures to deal with the effects coastal erosion would have on the main road in and out of the village. Suggestions included traffic calming, new roads being built, and using existing roads as a one-way system. Workshops 1 and 2 also suggested new housing developments in different parts of the village. Workshop 3 focused mainly on options to use and improve existing physical spaces such as the Pilgrim Shelter and new village hall. Figures 2f-2h shows three of the resulting modified visualizations shown to the participants during the workshops. Only one modified visualization per workshop is presented in this paper due to space constraints. The visualizations are representative of the types of changes participants at each workshop made. These were co-produced by the researcher and the participants in order to explore hypothetical future options. Figure 2f is one of the modified visualizations from workshop 3 and shows the types of small scale changes that were suggested. Figure 2g is the second housing visualizations created during workshop 1, after participants decided that this new location might be more beneficial for the village and perhaps of wider acceptance. Figure 2h was one of the modified visualizations shown in workshop 2. The discussion this generated led participants to agree that there should be housing development, but not large housing estate development in the village, indicating consideration of larger scale changes in the village. These visualizations are based on aerial views and used dots and basic shapes to show the suggested changes.

Themes such as underground drainage could not be visualized using VNS, although it was a high-ranking option among the workshop participants. Therefore, the next highest option was

visualized instead. In order to include drainage, participants in the first workshop decided to use housing as a means to improve the drainage in an area of the village they believed it would be helpful in dealing with coastal change. Workshops 2 and 3 made minor changes after modifying and discussing the visualizations, including adding trees as a barrier between the new housing development and the older part of the village, and the orientation of the new village hall to reflect its planned position.

Finally, participants were asked towards the end of the workshop how they would like to take the visualizations that were created forward. These varied between workshops, but two key future steps were identified: 1) using the visualizations to engage and inform the wider community, and 2) using the visualizations as a way to communicate with coastal planners that the village has thought closely about potential future changes. As some participants indicated during the workshop:

TV02: “I’d like them [North Norfolk District Council] to see some of this to see that we’ve actually thought some of this through. Then I can explain how we’d done it with you and how it was put together because I think when you actually start seeing some of these things laid out like this, it gives it a whole different perspective.”

TV03: “It’s better to have a visualization of what it is you’re thinking about.”

Another participant wrote in the post-survey of the workshops, “Having the freedom to imagine the implications of changes as if we were planners in the sky looking down, the exchange of ideas, often large scale, was also a trigger for new perspectives.”

4 Discussion and Conclusions

This paper presents preliminary findings from a study undertaken with participation of residents in a coastal village, focusing on workshops in which visualizations were shown to and modified by participants. The methodology includes pre- and post-surveys to evaluate the effectiveness the visualizations and utilizes qualitative and quantitative data collection methods to better understand the views and opinions of the participants in this research.

The preliminary findings show that participants consider visualisations to be a useful tool during discussion of future change. For some the discussions accompanied by visualisations served as a crystallization of their thoughts, seemingly for those who had already strong views and feelings about coastal change, while for others it served to generate new ideas and new ways of thinking. Any changes to perceptions cannot be attributed solely to the use of visualizations, but the process of creating the visualizations through the workshop activities and discussions was useful in understanding the thoughts and reasoning behind why participants chose certain options over others.

A consideration for future work is the time it takes to modify the visualizations during the workshop and how to overcome problems that can arise from using programs that require a lot of computing power in the field. VNS, although powerful in being able to modify the landscape, is not easy to use quickly with many modifications over a short period of time. Therefore, making modifications in real-time should be carefully considered when planning participatory activities.

Further analysis of other data in this study will enable further insights on how and why visualizations have been used and contributed in shaping the discussions on future change in the village. The processes through which participants have been involved over time deserve attention in relation to how these have affected participation and engagement with the research.

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