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Minions of Disruptions™: A Collaborative Adaptation Game for Promoting Climate Action

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Abstract. With the onset of climate change, adaptive action will have to occur at all scales, including locally. This implies a growing responsibility for the public and, therefore, a need to spread awareness and inspire climate action. Communication via adaptation games shows potential in achieving social learning and addressing the so-called knowledge-action gap. However, few research efforts so far give voice to participants engaging with collaborative games in organisational and community settings. This paper advances this field by presenting a systematic research reflection on a collaborative tabletop board game, Minions of Disruptions™. It addresses two research questions: first exploring how to design a collaborative adaptation game for the general public, and then determining how the intentions outlined by the game designers are perceived by the game participants. Ten core design intentions determined through a focus group interview with game designers and facilitators were contrasted against responses from the post-game survey administered to all game participants from 2019-2022. The results of this study indicate that the design intentions behind Minions of Disruptions were largely received by the intended audiences, demonstrating success as a communication tool for collaborative climate action. Moreover, important insights about designing adaptation games for the public are raised, which can aid in drafting guidelines for successful engagement.

1 Introduction

The impacts of climate change are intensifying, manifesting in extreme weather events that are becoming a norm rather than an anomaly (Seneviratne et al., 2021). The increasingly detrimental impacts on people's lives and livelihoods transform climate adaptation from a worst-case scenario to a reality that requires significant investments of resources at all levels: from government-led to individual household-level action (Noll et al., 2022). While adaptation has regionally and sectorally specific hard limits beyond which any adaptive action becomes impossible, concerted action can influence its soft limits, such as through lowering human system-related barriers, including limited financial resources. Today the majority of reported adaptation actions are happening on the individual and household levels (Berrang-Ford et al., 2021) and many adaptation solutions and trade-offs are best discovered and implemented locally (Moser and Pike, 2015). Therefore, successful society-

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wide adaptation is currently dependent on increasing local climate awareness (Illingworth and Wake, 2019) and capacity to make informed choices among those who are neither scientists nor policy-makers (Whitmarsh et al., 2013).

Prior instances of communicating adaptation to heterogeneous audiences has not resulted in the desired levels of public engagement and commitment (Whitmarsh et al., 2013; Ouariachi et al., 2017). Communication strategies tend to build around an information-deficit model, namely, the assumption that attitude and behaviour change is positively related to an increase in information about a topic; even if the effectiveness of this approach is increasingly questioned in engaging non-scientist audiences (Illingworth and Wake, 2019; Andersson et al., 2019; Badullovich et al., 2020). A so-called knowledge-action gap is used to describe a situation where the audience has the appropriate level of information, yet no adaptive behaviour emerges (Flood et al., 2018). Previous studies have found that a focus on the quantity of information may omit important considerations if unidirectionality renders the audience passive (Illingworth and Wake, 2019; Ouariachi et al., 2017; Parker et al., 2016; Illingworth and Jack, 2018); if jargon forms a barrier to comprehension (Illingworth and Wake, 2019); and if negative frames lead the audience to apathy by triggering feelings of overwhelm and hopelessness (Ouariachi et al., 2017; Moser, 2016). Hence, to bridge the gap, there is a call for more dialogical approaches to address the needs of diverse audiences (Illingworth and Wake, 2019; Illingworth, 2020; Kumpu, 2022).

The attention toward climate adaptation games has increased substantially in the last decade (Flood et al., 2018). There is increasing evidence pointing at the ability of games to address a wider range of audiences (Illingworth and Wake, 2019; Ouariachi et al., 2017; Parker et al., 2016), and enable social learning (Ouariachi et al., 2017; Flood et al., 2018; Den Haan and Van der Voort, 2018; Rumore et al., 2016). The field is still emerging, with several questions remaining unanswered, including how to make the game messages fit for audiences with non-science and non-policy backgrounds (Parker et al., 2016; Galeote et al., 2021; Neset et al., 2020).

This paper brings new insights into this topic by introducing a case study: an analogue and collaborative tabletop game, Minions of Disruptions™. The game, developed by a Dutch non-profit organisation Day of Adaptation in 2019, has an explicit objective to engage diverse organisations and communities in collective climate adaptation, regardless of their prior affiliation with climate change. This investigation contrasts two separate datasets to form a dialogue between the designers' intentions and the audience's perception. This article addresses the overarching question of what guidelines should be taken into consideration when designing analogue climate adaptation games for the general public. It is further explored in three specific sub-questions regarding the intentions behind the game design of Minions of Disruptions according to the designers and game facilitators, the extent to which the design intentions behind Minions of Disruptions are perceived by the game participants, and how the reception of the design intentions by the game participants align with the original objectives of the game.

This article is structured as follows: Sect. 2 discusses existing knowledge about adaptation games, and highlights gaps in relation to designing for the general public; Sect. 3 outlines the Minions of Disruptions case study and discusses the chosen research approach, data collection, and analysis; Sect. 4 introduces the results in two parts: design intentions and their alignment with the participant experience; and Sect. 5 relates the findings to previous research efforts, suggests a guideline for adaptation communicators, proposes future research directions, and outlines strengths and limitations of the study.

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2 Background: climate adaptation games

Games aiming to achieve social learning can be conceptualised as transitional objects (Den Haan and Van der Voort, 2018). This implies that they function as communication vessels that transmit messages predetermined by designers and facilitators and target an objective. Generally, climate games can be thought to have three kinds of objectives: (1) increasing awareness of climate challenges; (2) increasing general knowledge, familiarity, and understanding; and (3) encouraging solution-finding and action-taking (Reckien and Eisenack, 2013). Additionally, adaptation games have a broad topical range including resource and environmental management; farming; coastal development; supply chain logistics and transport; disaster preparedness and response; food security; global impacts and change; policy; and climate services (Flood et al., 2018).

Flood et al. (2018) argue that even though the field is emerging, games are proving to be powerful communication tools, helping to realise climate change adaptation faster than with other existing means. They are additionally proposed as a way to address the so-called knowledge-action gap (Flood et al., 2018; Ouariachi et al., 2020). Adaptation and climate games succeed in not only creating cognitive, but also normative and relational learning (Flood et al., 2018; Den Haan and Van der Voort, 2018; Rooney-Varga et al., 2020). The reason for their effectiveness is understood to be a consequence of the way games package and deliver information: they are often narrative-based (Flood et al., 2018), more memorable (Parker et al., 2016; Ouariachi et al., 2017), able to capture and explain complexity (Parker et al., 2016; Flood et al., 2018; Den Haan and Van der Voort, 2018), and relatable, as they make use of familiar and locally relevant themes (Parker et al., 2016; Rumore et al., 2016; Galeote et al., 2021; Mitgutsch and Alvarado, 2012; Rodela et al., 2019; Nussbaum et al., 2015). The style of participation is also different because it invites the participants to assume roles and makes information reception more active (Parker et al., 2016; Flood et al., 2018; Galeote et al., 2021; Fjællingsdal and Klöckner, 2020). The participants get the opportunity to explore real-time hypothetical scenarios, which can help make connections between action and impact (Flood et al., 2018; Fjællingsdal and Klöckner, 2020).

From the perspective of local level adaptation, multiplayer collaborative games are a particularly interesting avenue because they provide the possibility for relational learning, which includes gaining a better understanding of others' mindsets and increasing trust and the ability to cooperate (Den Haan and Van der Voort, 2018). Moreover, social simulations can enhance affective learning paths, namely, associating emotions such as concern, importance, and outrage with climate change (Rooney-Varga et al., 2020). If designed as a dialogical tool, games can help share and co-produce local knowledge (Flood et al., 2018; Den Haan and Van der Voort, 2018) and create an out-of-the-ordinary space for conversation (Flood et al., 2018; Rumore et al., 2016; Fjællingsdal and Klöckner, 2020) with fewer knowledge hierarchies (Illingworth and Wake, 2019; Illingworth, 2020; Rodela et al., 2019). Enabling such conversations is key in increasing normative reflexivity at the group level, which could change or facilitate internal decision-making (Flood et al., 2018; Rumore et al., 2016; Rodela et al., 2019). Games have also been seen to increase the perceived importance of cooperation, empathy, and respect toward other perspectives (Rumore et al., 2016; Galeote et al., 2021; Rodela et al., 2019; Abspoel et al., 2021), augment feelings of trust and ownership (Flood et al.,

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2018; Ouariachi et al., 2020), and even solve conflicts (Medema et al., 2016). Additionally, they may increase optimism about the effectiveness of local cooperation (Rumore et al., 2016; Galeote et al., 2021; Ouariachi et al., 2020).

While there is much traction around games, research gaps remain. Few climate games known to research propose collective-level solutions, create dialogue, focus on affective learning, or aim at achieving direct impact (Gerber et al., 2021). On the other hand, games enhancing cognitive learning are the highest represented in research, whereas normative and relational learning are rarely addressed (Den Haan and Van der Voort, 2018). Furthermore, games can fail to reach the objectives set for them: they sometimes narrate roles that the participants do not identify with (Galeote et al., 2021); fail to form linkages with real-life (Fjællingsdal and Klöckner, 2020); are not relevant (Lankford and Craven, 2020); or overwhelm participants with information, curtailing dialogue (Illingworth, 2020). There is an additional degree of ambiguity about the optimal medium: some studies question the effectiveness of digital games (Boomsma et al., 2018), whereas others find that, for example, video games deliver best results (Olivares-Rodríguez et al., 2022).

There are different climate game designs to address diverse target audiences, such as students, policy-makers, professionals, or the general public (Gerber et al., 2021). The "general public" in particular is often loosely defined, but here it is understood as a group that engages little with climate change in their day-to-day; they do not have a science background nor do they work with the topic professionally. This group tends to be the least represented in climate game reviews (Parker et al., 2016; Galeote et al., 2021; Neset et al., 2020), and generally in science engagement strategies (Illingworth and Jack, 2018). Gaining a better understanding of this interaction can help explain why the participants cannot always relate to the game content, or what kind of information might overwhelm them. The general public may have an attitude, cognitive style, or mode of learning that diverges significantly from that of the communicators, and therefore presents a particularly important dimension of study. Exploring this topic might, therefore, give answers as to what contributes to gaps between knowledge and action, and how they could be bridged.

Effective climate communication requires that the audience(s) is determined and well-known in advance (Illingworth and Wake, 2019) and that their needs are understood (Ouariachi et al., 2017; Flood et al., 2018; Monroe et al., 2019). Therefore, it is proposed that this study enhances the game field through deepening the understanding about the needs of the audience, and capturing their interaction with the game and the communicators. Designers play a key role in the outcome of the game, as they ultimately decide what information gets communicated via the game and in what way, thereby dictating what success looks like (Fjællingsdal and Klöckner, 2020). Scientific articles on climate games tend to focus on measuring the participant experience pre-, post-, and post-post game events (Flood et al., 2018; Den Haan and Van der Voort, 2018) and by doing so somewhat omit this relationship. In the interest of understanding how games could help realise rapid local-level adaptation, design and engagement guidelines are needed to inform future designs and game iterations.

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3 Method

3.1 Minions of Disruptions™

This research paper studies a collaborative and analogue tabletop game, Minions of Disruptions™, created in 2019 by a Dutch non-profit organisation, Day of Adaptation (https://dayad.org/). The organisation explores and innovates on climate communication, targeting specifically groups that tend to be left out of the conversation. "Game Day," a facilitated gameplay experience, is one of its communication tools. The game can be played by anyone, as there is no strictly defined target audience. However, there is a general player typology: players are predominantly adults of various ages or university students, representatives of the same or somehow affiliated communities and organisations, and most of the participants are not climate professionals nor students of climate sciences. All groups enjoy the privilege of time to dedicate for such an activity, the costs of which are covered by their employer or administration.

The data used in this study were collected by Day of Adaptation for monitoring and evaluation purposes (see Table 1 for an overview). There are both online and in-person versions of the same game activity with an even split between events organised in the Netherlands versus other countries. The range of organisation type is broad, and while the survey did not systematically measure the general level of climate knowledge or the level of gaming experience of the participants, anecdotally it can be said that it varies both between events and within groups. For instance, sometimes a Game Day might be organised by an employee who is part of a sustainability committee at the workplace. This individual is bound to have a different level of background knowledge in comparison with their colleagues. An average player is aware of the basics of climate change, however, not necessarily familiar with its causes and consequences. Some groups or individuals might be taking some collective climate action already, whilst others are only getting started, and hope to use the event to kickstart and get their team or organisation engaged and involved.

Table 1. The dataset used in this study, comprising 18 Game Days that took place between 2019 and 2022.

ID	Date (y-m-d)	Organisation type	Country	Game Version	Participants	Surveyed Participants	Survey Participation (% of Participants)	Sample Distribution (% of total surveyed)
1	2019-12-02	University	Netherlands	In-person	25	19	76	13.57
2	2020-04-16	Activist Group	Netherlands	Online	3	2	66.7	1.43
3	2020-06-28	Association	Netherlands	In-person	5	4	80	2.86
4	2020-08-19	Bank	Netherlands	In-person	12	2	16.7	1.43
5	2021-01-24	Community of Climate Professionals	Netherlands	Online	60	14	23.3	10.00
6	2021-04-05	Activist Group	Chile	Online	4	3	75	2.14

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7	2021-04-23	Non-profit Organisation	Germany	Online	9	6	66.7	4.29
8	2021-04-26	University	Philippines	Online	20	20	100	14.29
9	2021-04-28	Social Movement	UK	Online	8	5	62.5	3.57
10	2021-05-06	Non-governmental Organisation	Netherlands	Online	7	1	14.3	0.71
11	2021-05-12	University	Mexico	Online	13	10	76.9	7.14
12	2021-09-03	University	Netherlands	In-person	33	1	3.0	0.71
13	2021-09-03	Cross-regional government mandated body	Netherlands	In-person	19	16	84.2	11.43
14	2021-10-01	University	Netherlands	Online	35	1	2.9	0.71
15	2021-10-30	Development Institution	Saint Vincent	Online	9	6	66.7	4.29
16	2021-12-08	University	Sweden	In-person	25	10	40.0	7.14
17	2022-05-24	Private Company	Australia	Online	10	5	50.0	3.57
18	2022-05-25	Private Company	Australia	Online	24	15	62.5	10.71
	Total				**321**	**140**		**≅100**

3.1.1 The gameplay

The standard format for a session is a three-hour game activity, which can take place either in person or online. In-person events use physical versions of the game, while online events utilise an online conferencing software and Tabletopia. Tabletopia is a digital sandbox system for playing board games with no AI to enforce the rules, which allows for the game pieces to be manipulated by the players as they please, creating a life-like board game situation. Because the online version provides no feedback or automation, the in-person and online experiences are comparable for the purposes of this study.

Groups opt to play either a community or organisation version of Minions of Disruptions™ (see Fig. 1 for an example board). While the basic rules of the game are the same regardless of the version, the content is somewhat adjusted: the community version focuses on services such as housing, and the organisation version on operational functions. Sometimes the game content is even further adjusted, if requested by the community/organisation during the planning phase.

All events begin with splitting the group into teams of 3-4 people, each with their own board. The teams are given the basic rules of the game after which they learn the game experientially. All teams have the same goal: to implement climate actions strategically and collaboratively in a game world where increasing carbon levels in the atmosphere increasingly slow them down and inflict continuous disruptions. The team also needs to balance financial costs and can negotiate with other teams to move forward faster. Occasionally they are invited to share real-life knowledge and experiences, which have an impact on

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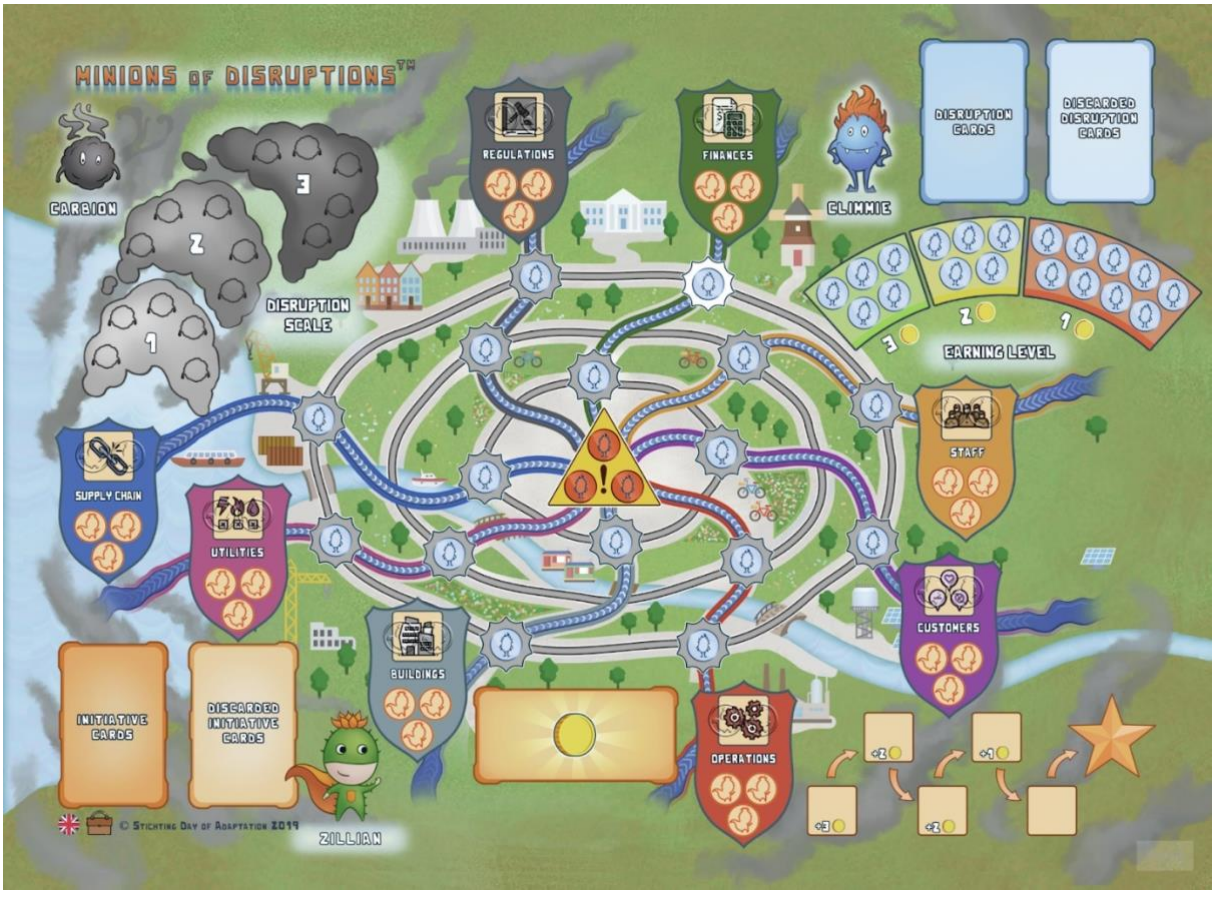
their gameplay. A team wins the game by protecting five of their organisation/community's essential sectors against disruptions, indicating climate resilience.

Gameplay takes 60-90 minutes, with the remaining time used for a brief warm-up and facilitated debrief. Depending on the participants' wishes the facilitators may include supporting team-building activities, and introduction of basic terminology (e.g., mitigation, adaptation). The debrief includes discussions of how realistic the game felt, what climate change looks like for the organisation/community in question, and what kind of preparatory action can be taken to mitigate or adapt to the real-life disruptions.



(c) Stichting Day of Adaptation 2019

Figure 1. The visual layout of the Minions of Disruptions™ game board, which models climate disruptions in an organisation. The operational functions, or "shields", include operations, customers, staff, finances, regulations, supply chain, utilities, and buildings.

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3.2 Methods and datasets

The most common way to evaluate games is to capture data during the game experience, or combine pre-, post- and post-post game surveys that collect participants' self-reflections (Flood et al., 2018; Den Haan and Van der Voort, 2018). If the objective is to capture social learning, however, it has been found that there are several confounding factors that may mislead the findings, such as preconceived notions about games, the agency of facilitators, and the prior in-group relations (Den Haan and Van der Voort, 2018). Arguably, intention-based designs, such as this, should be analysed in relation to their purpose (Neset et al., 2020). With the purpose of addressing some of these confounding factors and elaborating on the purpose of Minions of Disruptions™, this paper adopts a mixed-methods approach that combines data from game designers and facilitators with data collected from game participants. The aim of these methods is to create a clearer understanding of games as transitional objects by establishing a connection between design intent and how the gaming experience is received by participants. For the purposes of this study, this connection remains qualitative due to the subjective and narrative nature of the data and the lack of strict uniformity of the game events. The conclusions drawn through this mixed-methods approach contribute to a validated foundation off which future quantitative studies could be built.

3.2.1 The designer perspective

A 1.5-hour online focus group interview was organised in April 2022 with three game designers/facilitators and two facilitators from Day of Adaptation. This sample represents the majority of the designers, and at the time of the study, approximately a third of the active facilitators. The researchers set up the focus group with the objective of capturing *design intentions*, meaning, what kind of messages the designers and facilitators wanted to convey to the audience and what kind of elements they designed to fulfil this objective (e.g., tangible game pieces, rules, etc.). The participants were informed about the purpose of the focus group prior to and during the data collection, and they all consented to being featured in this research.

Focus group as a method of data collection is often used when interviewees have a history of working together, when it is assumed that benefits can arise from immediate cross-checking of statements on a group-level, and when researchers wish to generate representative data whilst being mindful of participants' and their own time constraints (Creswell, 2013). In this case, most participants, and all designers, had worked together previously. Given that three years had passed since the creation of the game, and two of the participants have not been involved with Day of Adaptation since, the focus group was intended to serve as a way to have an agreeable re-encounter, to help refresh memories, and bring about consensus-based answers to the interview questions. While laying the groundwork for the research, eight participants in total were invited to take part, but three were unable to attend.

This method has its pros and its cons. For the pros, it poses less pressure on a single participant and, therefore, given participants' busy schedules, it was considered the best option. Additionally, the organisers aimed to make the experience as stress-free as possible, and therefore, in addition to the researcher in charge of leading and directing discussion, two co-organisers joined the session to manage the technical side, and to note observations. No technical difficulties emerged,

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however, in the case they would have, the session would have been temporarily paused or postponed to ensure good quality discussion. The participants could, thus, simply focus on thinking, commenting, and answering questions, which helped to make the best use of their time and generate a great quantity of data in a short amount of time. Another benefit of the method was that there was no need to cross-check answers as that could be done in real time during the focus group.

For the cons, a focus group, as any group situation, is bound to follow pre-established group logics and power dynamics, which may influence which data are generated or excluded by the group. Moreover, such a form of interaction may not suit all personality types, and can favour individuals who are more inclined to speak in a group setting. Further, with small group sizes and self-reporting, there is the potential for biases such as social desirability bias, in addition to memory recall errors and reliance on subjective interpretations of individual experiences. A careful design of a focus group is key in making sure that there is a chance for equal participation and room for discussing diverging opinions. In order to mitigate issues related to memory, the participants first got time to inspect the game board to trigger their visual recollection. The researchers aimed to enable such a space through specific design choices: in most cases participants were asked to answer in randomised turns, instead of giving an open floor, and they were also directly asked to comment on each others' contributions. Furthermore, both the designers and game facilitators were included in the same session. This allowed the game facilitators to pose questions to the designers, which could help challenge the internal dynamic of the designer group.

The session was managed with Zoom and Miroboard-platforms. As a warm-up, the participants took turns listing what different game elements they could remember, adding to each other's knowledge. In the second part, these game elements were momentarily set aside, and the participants were asked to reflect on high-level design intentions of the game and what core ideas it aims to address. In the third part, the game elements were reintroduced and the participants were asked to connect and cluster them with the design intentions.

3.2.2 The participant perspective

The audience perspective is taken from a standardised post-game survey that all game participants were asked to fill out at the end of their group's Game Day. This survey is designed to collect monitoring and evaluation data for Day of Adaptation and was not originally intended to be used for research as such. The organisation gave consent to analysing these data, and the researchers received it anonymised so that only the organisation names and some basic demographic data were retrievable. The survey participants have not given their explicit consent for this research, but their participation in the original post-game survey was voluntary and they could opt-out from any question. To protect the integrity of the participants, demographic data are only treated on a general level so that it cannot be connected to any particular organisation or individuals. The age of participants spans from 18 to 65+, with an average age of 32 years. More than 60 percent of the participants identify as female, 36 percent as male, and 2 percent as non-binary. The participants represent a wide variety of organisations (see Table 1 for the breakdown of organisations included in the analysis). Anecdotally it can be said that apart from the student groups, the groups are teams that work together directly or under the same organisation, representative of a variety of job levels.

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Previous survey research on games has found that not only is it a quick and inexpensive method to measure immediate impact, but it can also be considered robust insofar as the data are representative of a great number of game events (Flood et al., 2018). In total there are 140 survey answers from 18 game activities, played between 2019-2022, including both the online and in-person versions of the game. The survey consists of multiple choice and open field questions, but only the latter was included in this study, as it was considered better-suited to answer the research questions of this paper.

3.3 The analysis

The analysis consisted of two steps. In the first step, the data collected during the focus group inquiry were processed; the recording was transcribed and participants were anonymised. During the focus group, the participants agreed in consensus upon ten design objectives and related them to game design elements. While engaging in dialogue, their answers were simultaneously modelled on a Miroboard by the organisers. The participants could immediately react to the accuracy of the visual representation via screen-sharing. To ensure that all of the expressed ideas were correctly interpreted after the focus group, the transcription and the language used by the participants was contrasted with the visual representation. The transcription was prioritised in order to capture ideas that might have been omitted during the interpretation process.

The second step of the analysis mapped out how game participants perceived the game as a transitional object conveying the ten design intentions. Once the ten design intentions were established, two researchers conducted independent Excel analyses that coded the open-field questions of the post-game survey for all participants both into the design intention categories and then for positive, negative, or neutral alignment with the design intentions. Statements were permitted to have no more than two design intention categorisations as an analytical boundary imposed by the researchers. It is recognised that this may lead to a simplified version of reality. The aim was to connect entries with evidence for and against the fulfilment of a design objective. The two independent analyses were compared and negotiated between the researchers to arrive at a mutually agreed upon categorisation. This information is discussed both for the whole population as well as divided based on how the game was presented, either online or in-person, to demonstrate the general reception of the game as well as to observe any potential variance based on experience. Individual groups were not analysed on their own due to wide variation in the number of respondents per session. While this approach could potentially lead to one group's poor experience skewing the analysis, it was determined to be acceptable because of the consistency observed in the data between groups.

4 Results

4.1 The design intent

The focus group participants elaborated on ten design intentions that they aimed to achieve with the game, as well as various design elements included to achieve the intentions. The design elements have been categorised in line with an applied framework combining typologies from Gerber et al. (Gerber et al., 2021), Lankford and Craven (Lankford and Craven, 2020)

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and Razali et al. (Razali et al., 2022) and are elaborated upon in Appendix 1. The following ten design intentions, in alphabetical order, were agreed upon by the focus group participants:

1. **Adaptive Action:** Addressing climate action both from mitigative and adaptive perspectives.
2. **Climate Science:** Increasing awareness of basic climate change elements in daily lives, as well as the anthropogenic cause-and-effect of climate change.
3. **Collaboration:** Addressing both individual and collective action, but taking the organisation/community as the starting point.
4. **Language:** Communicating with simple language so that the game is accessible for a wider audience with varying education levels and interest.
5. **Moderation:** Autonomous gameplay with minimal moderation to emphasise the agency of the team.
6. **Organisational Relations:** Increasing understanding of the complexity of connectivity and interaction of essential services and functions of organisations and communities in an era of climate change.
7. **Psychological Resilience:** Triggering reflections within participants on adjusting to a new climate and its consequences.
8. **Relatability:** Being relatable through incorporating relevant current events, research, and unique examples from participants' lives.
9. **Setting:** Creating a fun and welcoming space to inspire and increase motivation to act through a positive solution-frame.
10. **Team-building:** Increasing intra-organisational conversations despite existing hierarchies; learning to collaborate and enhancing team-building to build bridges and synergies that can help with action-taking.

4.2 The participant experience

The ten game design intentions identified by the focus group participants created a framework through which to measure the impact of the game. All open-field responses of the post-game survey were coded into these intention categories. One hundred and forty participants responded to the survey, with 52 respondents from in-person Game Day events and 88 from online events. Not all participants answered every question, and 115 statements were omitted from the analysis due to ambiguity. Sixty-nine statements fell into two different design intention categories and were therefore counted twice. In total, 265 unique responses were included in this analysis, combined with the 69 responses falling into two categories for a total of 334 statements to be categorised (89 in-person and 244 online). Raw participant and statement numbers can be found in Table 2.

Table 2. Total number of participants and statements included in the analysis with breakdown between in-person and online events.

	Total Participants	Single Theme	Two Themes	Total Unique Statements	Total Statements Analysed	Total Statements Omitted

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Question 2: How would you rate your Game Day experience?						
Total	140	20	4	24	28	7
In person	52	1	0	1	1	1
Online	88	19	4	23	27	6
Question 3: What are the new perspectives or deeper understanding on climate action that you have gained on the topic, if applicable?						
Total	140	59	24	82	106	21
In person	52	15	8	23	31	8
Online	88	44	15	59	74	13
Question 4: What is your key take-home message from the Game Day?						
Total	140	57	27	84	111	32
In person	52	18	7	25	32	12
Online	88	39	20	59	79	20
Question 5: How would you rate the organisation of the event? E.g. orderliness, easy to follow, engaging, etc.						
Total	140	35	3	38	41	9
In person	52	11	0	11	11	4
Online	88	24	3	27	30	5
Question 6: How would you rate the facilitator's performance? E.g. they explained things clearly, listened well, were engaging, etc.						
Total	140	15	6	21	27	25
In person	52	4	1	5	6	4
Online	88	11	5	16	21	21
Question 8: Any other comments or suggestions?						
Total	140	11	5	16	21	21
In person	52	2	3	5	8	3
Online	88	9	2	11	13	18

All design intentions were represented in the survey responses, though with varying frequency. *Adaptive Action* was the most represented design intention (20.96% of total), while *Psychological Resilience* was the least represented as a percentage of the total responses (1.5%) (Fig. 2). Following *Adaptive Action* were *Setting* (15.27%), *Moderation* (14.07%), *Collaboration*

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(13.77%), *Climate Science* (11.98%), *Relatability* (7.19%), *Language* (6.29%), *Organisational Relations* (5.09%), and *Team-building* (3.89%).

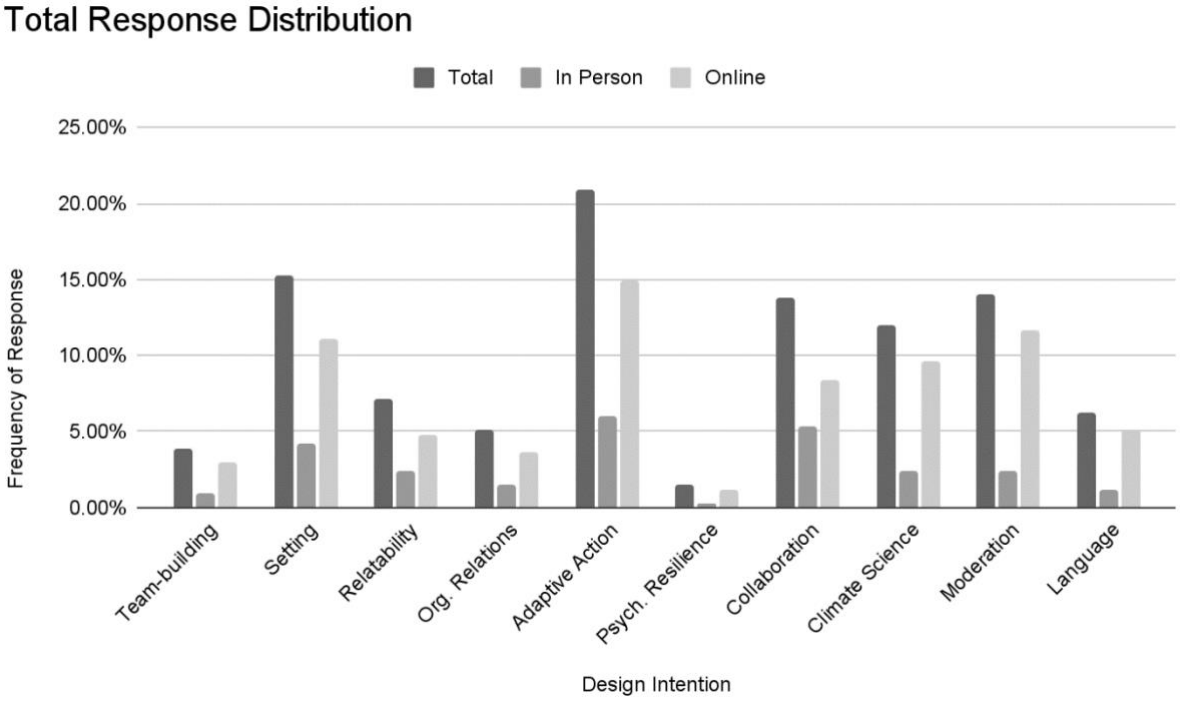

Figure 2. Distribution of responses between each design intention and divided by in-person and online events (% of total).

4.2.1 In-person versus online events

In-person participants accounted for 37% of survey respondents and approximately 26% of statements analysed. All design intentions were represented in responses as shown in Figure 3.

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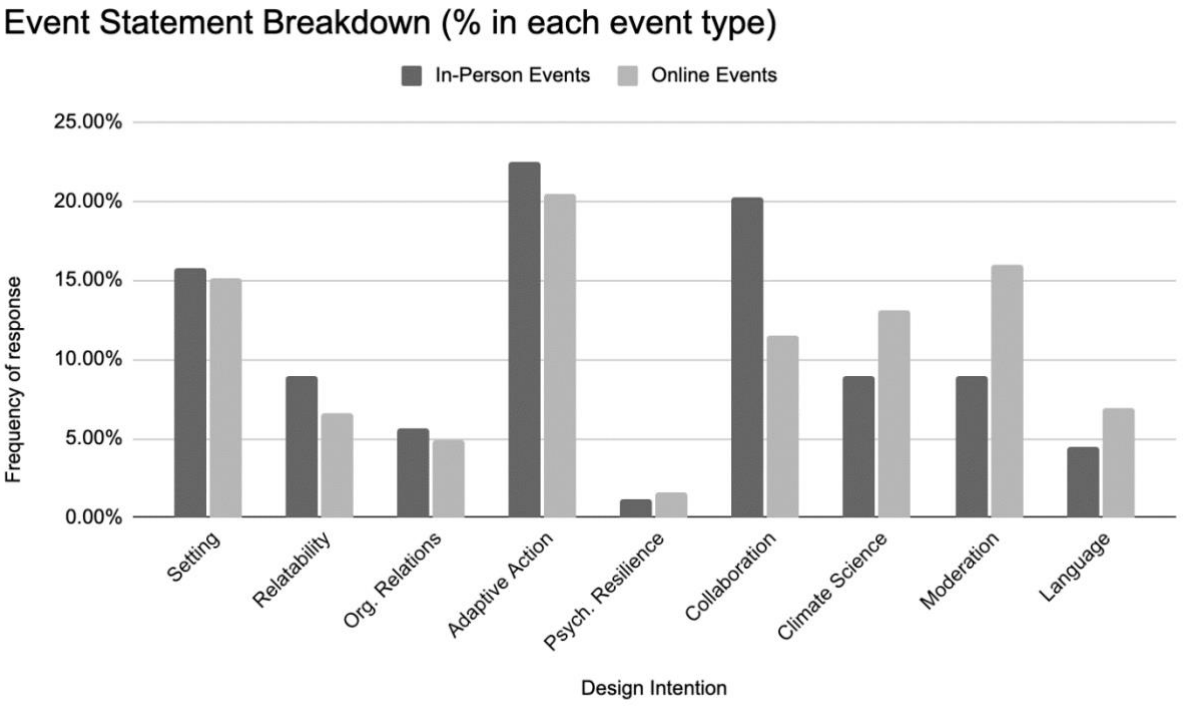

Figure 3. Distribution of design intentions within statements given from in-person events and online events (percents from within each event separately).

Though all intentions were mentioned, 42.7% of all statements fell into just two categories: *Adaptive Action* (22.5%) and *Collaboration* (20.2%). *Setting* (15.7%), *Climate Science* (9.0%), *Relatability* (9.0%), and *Moderation* (9.0%) also had a combined total of 42.7%, with these six design intentions dominating 85.4% of the statements included. The remaining four intentions, *Organisational Relations, Language, Team-building, and Psychological Resilience*, were the least represented.

Participants in online events accounted for approximately 63% of survey respondents and 73% of statements analysed. All design intentions were represented in responses as shown in Fig. 3, with a slightly more balanced distribution than noted in the in-person survey responses.

For online events, *Adaptive Action* was the most referenced intention at 20.4%, which is similar to the frequency found in in-person events (22.5%). *Moderation* and *Setting* were nearly tied for the second-most referenced design intention (15.9% and 15.1%, respectively), followed by *Climate Science* (13.1%), and *Collaboration* (11.4%), for a combined total of 75.9% of statements analysed. The remaining five design intentions, *Accessible Language*, *Relatability*, *Organisational Relations*, *Team-building, and Psychological Resilience* accounted for the final 24%. With the exception of *Relatability*, the least represented design intentions are consistent between in-person and online respondents.

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4.2.1 Design intention and response alignment

While the initial part of this analysis demonstrates the frequency of the design intentions in survey responses, additional analysis was required to determine whether the statements align with or contradict the game designers' original intentions. Of the ten design intentions, all except *Accessible Language* and *Moderation* had overall positive averages in the survey responses (-0.333 and -0.383, respectively). *Team-building* and *Collaboration* had the highest overall averages at 1.000, followed closely by *Organisational Relations* (0.941) and *Climate Science* (0.900). *Adaptive Action* (0.800), *Relatability* (0.750), *Psychological Resilience* (0.500), and *Setting* (0.353) complete the list of positively aligned survey responses (See Table 3).

Table 3. Alignment rankings of each design intention, including to overall average, and adjustments for in person and online events.

Design Intention	Overall Average	In Person Average	Online Average
Adaptive Action	0.800	0.600	0.880
Climate Science	0.900	0.750	0.938
Collaboration	1.000	1.000	1.000
Language	-0.333	-0.500	-0.294
Moderation	-0.383	-0.500	-0.359
Organisational Relations	0.941	1.000	0.917
Psychological Resilience	0.500	1.000	0.333
Relatability	0.750	0.625	0.813
Setting	0.353	0.786	0.189
Team-building	1.000	1.000	1.000

The alignment changes when adjusting for in-person versus online Game Days. For in-person events, *Team-building* and *Collaboration* were joined by *Psychological Resilience*, and *Organisational Relations* at the 1.000 average, while *Moderation* and *Language* remained negatively ranked. The online Game Days maintained the same rankings as the overall average for all intentions except *Organisational Relations* and *Climate Science*.

When comparing the reception between in-person and online events, in-person events had five design intentions scoring lower than the online average (*Moderation*, *Language*, *Relatability*, *Adaptive Action*, *Climate Science)*, while *Setting*, *Psychological Resilience*, and *Organisational Relations* scored lower for online Game Days. *Collaboration* and *Team-building* maintained a 1.000 average for both online and in-person events (Fig. 4).

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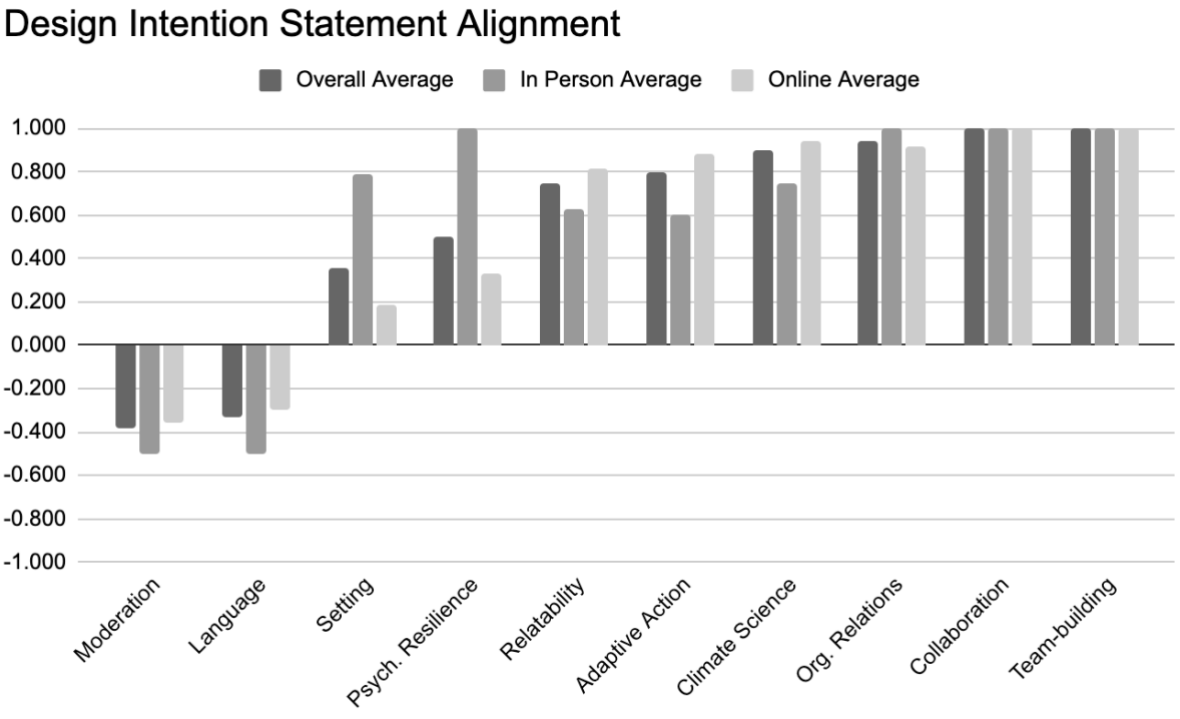

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Figure 4. Positive/Negative statement alignment with each design intention for overall, in-person, and online Game Day events.

5 Discussion

5.1 Understanding the results

5.1.1 Designer perspective

350 The inquiry yielded 10 distinct design intentions and 15 design elements, the latter of which includes aspects of medium, challenge, reward, level of abstraction, and player interaction, which the interviewees said were incorporated to realise the design intentions. For conceptual clarity the 10 design intentions are separated here into two categories. The first category is Primary Objectives, which describes the substantial content of the game. It was found deductively by contrasting the design intentions with Reckien and Eisenack's (Reckien and Eisenack, 2013) three-fold objectives, and seeing that some design
355 intentions aim to raise awareness (*Climate Science* and *Psychological Resilience*), increase knowledge, understanding and familiarity (*Organisational Relations*); and promote action-taking or solution-finding (*Adaptive Action* and *Collaboration*). The corresponding design elements are shown in Table 4.

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Table 4. Presentation of the design intentions and elements of Minions of Disruptions in connection with game objectives as theorised by Reckien and Eisenack.

Primary Objective	Design Intention	Design Elements
Raise Awareness	1. Climate Science 2. Psychological Resilience	Aesthetic Experience Audiovisual Cues Challenge: Time Constraints Challenge: Uncontrollable Events Discussion Medium: Board Medium: Cards for Action Player Interaction: Collaboration/Competition between Teams
Increase Knowledge, Understanding, Familiarity	1. Organisational Relations	Abstraction Level: Qualitative Description Audiovisual Cues Challenge: Limited Funds Challenge: Time Constraints Challenge: Uncontrollable Events Discussion Medium: Board Player Interaction: Collaboration/Competition between Teams Reward Role Play: Explicit Role Assignment with Optional Roleplay Tactical Decision Simulation
Promote Action-taking and Solution-finding	1. Adaptive Action 2. Collaboration	Challenge: Uncontrollable Events Discussion Medium: Cards for Action Player Interaction: Collaboration/Competition between Teams Player Interaction: Team Collaboration Reward Tactical Decision Simulation

The remaining five design intentions, *Language*, *Moderation*, *Relatability*, *Setting* and *Team-building*, relate less to the game's content, but rather prescribe how the substance is to be conveyed. It was found that they closely correspond to the general climate change engagement framework by Ouariachi et al. (Ouariachi et al., 2020), as illustrated in Table 5. Here they are referred to as Secondary Objectives, as they are not lone-standing, but support reaching the Primary Objectives. For instance, what the engagement framework defines as 'Concrete' is well-aligned with what the designers call *Language*: both aim to package information in a way that is accessible and relevant to the audience in question who is expected to respond better to less abstract information.

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Table 5. Minions of Disruptions' design intentions and elements connected with Ouariachi et al. climate engagement framework.

Secondary Objective	Design Intention	Design Elements
Achievable, Credible and Identity-driven	Relatability	Abstraction Level: Qualitative Description Audiovisual Cues Challenge: Uncontrollable Events Discussion Medium: Board
Concrete	Language	Aesthetic Experience Kinaesthetic Experience Character Design Discussion
Social and Reward-driven	Team-building	Discussion Moderation Type: Instructionist with constructionist elements Player Interaction: Collaboration/Competition between Teams Player Interaction: Team Collaboration Reward Role Play: Explicit Role Assignment without role play Tactical Decision Simulation
Fun, Meaningful and Reward-driven	Setting	Audiovisual Cues Challenge: Time Constraints Discussion Moderation Type: Instructionist with constructionist elements Player Interaction: Collaboration/Competition between Teams Player Interaction: Team Collaboration Reward
Experiential Learning	Moderation	Discussion Moderation Type: Instructionist with constructionist elements Player Interaction: Team Collaboration

Unpacking the game design of Minions of Disruptions confirms the preconceived notion that adaptation games offer the possibility for highly complex communication. Moreover, the messages that the designers want to convey are very nuanced and specific, showing that there is space to define objectives in higher resolution under Reckien and Eisenack's three-fold division. On the other hand, connecting the specific design intentions with the design elements in Table 4 gives an idea of how the messages are constructed with the help of different game mechanics.

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Table 5 shows a blueprint of the engagement strategy that was designed with the intention that it would fit the needs of the general public. By separating design intentions into objectives and engagement strategy, the topic could be separated from the means. The characteristics and needs of an audience need to be understood if they are to be successfully engaged (Flood et al., 2018; Ouariachi et al., 2017, 2020). For future game iterations and without compromising the action messages that the game is aiming to convey, the information gained about the audience through this study can be used to enhance the engagement strategy, specifically focusing on the Secondary Objectives.

5.1.2 Participant perspective

As with any communication, messages about climate change are transformed by the receiver; they do not simply flow unchanged from a designer to the audience (Illingworth, 2020). It, therefore, helps if the audience(s) is determined and well-known in advance (Illingworth and Wake, 2019). This study explored a new way of understanding the participant perspective by contrasting the designers' intentions with a post-game monitoring and evaluation dataset. As the questionnaire was not designed to capture alignment with the design intentions, it can be said with somewhat high confidence that the results organically represent the strongest and weakest communication aspects of the game across the data sample.

Surprisingly, even when controlling for online/in-person interactions, all of the design intentions were referred to by the survey participants. This is interpreted as validating the focus group method used to retrieve the design intentions. Furthermore, it shows that despite the degree of design complexity, the game succeeds in transmitting all of its communication components. Thus, the interesting question becomes where it was least and most successful. Considering first the Primary Objectives, a great deal of variability could be detected in the distribution of answers: nearly two out of three of the participants referring to Primary Objectives mentioned the action-taking/solution-finding dimension. The second biggest category was awareness-raising. This paints a picture that the participants mostly perceive messages about *Adaptive Action* and *Collaboration*, while few expressed comments about *Psychological Resilience* and *Organisational Relations.*

All Primary Objectives were found to be positively aligned with the original design intention, indicating success in conveying the original message to the audience. *Collaboration, Organisational Relations* and *Climate Science* were particularly successful in this regard. *Adaptive Action* largely aligns, yet a small number of participants expressed diverging experiences: some perceived that climate action was poorly-elaborated, it was shallow, overly complex, not realistic, or easy to fail at. In terms of *Psychological Resilience,* there was only one participant who perceived that the game added to their despair. However, given the infrequent mention of the category it ranks lowest in the alignment.

Table 6. The ranking of design intentions within the Primary Objectives by frequency (% of both Primary and Secondary responses) and alignment with the original intent (-1 - +1 scale).

Ranking by frequency	Ranking by alignment

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1. Adaptive Action (21%) 2. Collaboration (14%) 3. Climate Science (12%) 4. Organisational Relations (5%) 5. Psychological Resilience (1.5%)	1. Collaboration (1) 2. Organisational Relations (0.94) 3. Climate Science (0.9) 4. Adaptive Action (0.8) 5. Psychological Resilience (0.5)

Of the Secondary Objectives, *Setting*, *Moderation* and *Relatability* were the most commonly referenced, with *Setting* and *Relatability* positively aligning with the design intention. It should be noted that when controlling for an online versus in-person game experience, *Setting* shows the starkest contrast: the perception of the in-person experience is very positive, whereas the online one is noticeably lower, albeit still positively aligned. This contrast can be explained by the frequently cited technical difficulties reported by the survey participants. *Team-building* ranked the highest in alignment with an overwhelmingly positive reception, but it was also one of the least mentioned design intentions.

Moderation and *Language* were the only two intentions that were negatively aligned with the original intention, with *Moderation* being the least aligned. While some participants reported enjoying the degree of facilitation, a large number of participants would have either liked to receive more, or conversely, less instructed gameplay. The *Language* intention was also negatively aligned and is closely related to *Moderation.* Participants experienced confusion in terms of game components and the instructions they were given, and some felt that trying to understand the game detracted from their capacity to reflect on the topic. However, other participants reported that the game was simple to understand.

Table 7. The ranking of design intentions within the Secondary Objectives by frequency (% of both Primary and Secondary responses) and alignment with the original intent (-1 - +1 scale).

Ranking by frequency	Ranking by alignment
1. Setting (15%) 2. Moderation (14%) 3. Relatability (7%) 4. Language (6%) 5. Team-building (4%)	1. Team-building (1) 2. Relatability (0.8) 3. Setting (0.4) 4. Language (-0.33) 5. Moderation (-0.38)

5.2 Lessons learnt

The purpose here was to advance the field by drafting guidelines for communicating adaptation to the general public. Adaptation at a local level, among groups of non-professionals who are reliant on local trade-offs and knowledge exchange (Moser and Pike, 2015), can be facilitated via games, which create space for unordinary, and potentially transformative, conversations. Minions of Disruptions™ makes an interesting case study because of its focus on collective action and direct impact, as well as affective and relational learning, which are features seldom represented by other climate

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games. Many games tend to focus on cognitive learning (Gerber et al., 2021) and take the underlying assumption that increasing knowledge on adaptation will lead to more adaptation. However, research demonstrates that it is not solely the lack of information forming a barrier to action. Therefore, only focusing on measuring the degree of learning from a baseline to post-game may mislead one to think that barriers to action are being brought down.

This study diverges from such approaches by looking at the challenge from a different angle: how the intended messages are being received, and if the participants are being engaged in a way that appeals to them. Given that such a focus has not, to the knowledge of the authors, been tested previously, this paper adopted a qualitative approach to gain insights on what can be learnt by asking such questions. This section of the paper discusses the key findings and insights from the analysis.

5.2.1 Inclusion of the participant perspective

There is a tendency in communication research to treat participants as recipients of information instead of persons actively engaging in a dialogue with the communicators, giving meaning to climate change and action (Illingworth and Jack, 2018; Kumpu, 2022). There is a risk that in such cases only aspects that the communicator deems important are measured, which may result in omitting important participant perspectives. Given the concern that misunderstanding central game assumptions leads to iterations that do not bring about learning (de Kraker et al., 2021), deepening the understanding of the interaction between designers and participants is important. Intuitively, the importance grows when communication is targeted at audiences whose world view and learning methods significantly differ from that of the game designers: as is allegedly the case when climate professionals communicate adaptation to the general public via games (Illingworth, 2020).

By focusing on this interaction, instead of learning, the method applied here helped discern both strong and weak aspects of the communication, and served as the beginning of a dialogue between designers, facilitators, and the target audience of the game; feeding into monitoring and evaluation of the Game Day experience. Overall, the perception of the game is positive and aligns with the design intentions, which is an encouraging signal to develop similar designs or iterations of this game approach for similar non-professional audiences. As one participant summarised “This is definitely a very easy but effective way to engage my colleagues and friends about a serious subject of climate action”, meaning that the game can help develop context and common language around the difficult topic.

Similar to other studies, the method used confirms that not only do individual game sessions lead to dissimilar results (Illingworth and Wake, 2021), but also that each audience member has unique perceptions of the messages conveyed. Aggregating these results helps construct a picture of aspects that were most favourably regarded (approaching adaptive action from collective and community/organisation level) and where the most distortion in communication emerged (engagement strategy built around limited moderation and language used in the game).

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5.2.2 Collective action – communities and organisations at the system level

Few adaptation measures are taken by single individuals, instead requiring collaboration on shared problems and negotiating differences in opinions (Rumore et al., 2016). Nevertheless, the community or organisation-centred system level remains mostly unexplored by climate games (Gerber et al., 2021). Much like other adaptation games, Minions of Disruptions™ conveys messages with individualistic frames, breaking down complex scientific information to participants and pursuing cognitive learning, but it also aims to achieve relational learning by addressing the collective (Flood et al., 2018). From a theory perspective, this could create an out-of-the-ordinary scenario for the participants, which invites them to collectively explore alternative models for action (Illingworth, 2020). Here, *Collaboration* and *Team-building* turned out to be most well-received by the participants, signalling that this approach is welcomed as a way of communicating adaptive action to the general public. Participants shared their key learning insights such as, "Collaboration must be done not only in the game but also in real life, because it would help battle climate change and mitigate the pollutants and environmental pressures" and "Many people have interesting ideas on what we can do. We should use more the knowledge of the people around us and make it actionable"; and "Our actions generate externalities and affect the most vulnerable groups. To achieve climate justice it is necessary to work as a team." This shows clear support of the model adopted by the designers: a tactical decision simulation which requires collaborative adaptation, and a narrative built around climate disruptions and team resilience.

Research has found that climate games sometimes struggle being relatable and relevant (Fjællingsdal and Klöckner, 2020). Minions of Disruptions succeeds, however, in its intention of *Relatability*. This is encouraging given that if the audience perceives information as relevant and engages with it in a dialogue, further action becomes more likely (Galeote et al., 2021). The reason for its effectiveness here might have to do with the system level introduced: connecting knowledge, represented by *Organisational Relations*, through the workplace guarantees a degree of familiarity and affection. Moreover, a good narrative is key for decreasing abstraction for the general public (Ouariachi et al., 2017) and relating the game to participants' experiences (Illingworth, 2020). The narrative of Minions of Disruptions presents a three-fold challenge common to most organisations: lack of time, resources, and control. By playing together not all challenges are solved, but general resilience is gained, which appears to be a good pathway on making climate change relatable for the general public.

Roleplay is frequently cited as an important factor contributing to learning through games (Parker et al., 2016; Flood et al., 2018; Galeote et al., 2021; Fjællingsdal and Klöckner, 2020; Gerber et al., 2021). This case study confirms this in the sense that immersing oneself into a game as a community member or a member of an organisation appears to be an effective way of accessing the narrative. Additionally, this shows potential in triggering spill-over behaviour models from games to real life, as the imagined threshold for action lowers (Ouariachi et al., 2017; Parker et al., 2016; Illingworth, 2020; Flood et al., 2018; Den Haan and Van der Voort, 2018; Fjællingsdal and Klöckner, 2020). However, Minions of Disruptions also gives the option to roleplay different characters - for instance, people in more vulnerable or powerful positions - which could contribute to relational learning as described by den Haan et al. (Den Haan and Van der Voort, 2018). This message was not referenced by the participants, however, showing preference for playing as oneself. This is not surprising given that the experience for

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participants unfamiliar with games or climate change can already be overwhelming by itself. It is suggested that this type of roleplay is possible and could lead to interesting reflections relevant for relational learning, though it is more likely achieved if the game experience was repeated a second time with the same group.

5.2.3 Online or in-person engagement?

Many climate games have the tendency to focus on digital rather than analogue experiences (Illingworth and Wake, 2019) and computers are often used to interact with the general public. While Minions of Disruptions™ should not be compared to virtual games as such, the case study did bring about interesting results when the answers were controlled for different game environments. The general experience was somewhat different as *Setting* and *Psychological Resilience* came out as much more prominent in the in-person setting compared with the online environment. This suggests that creating a fun and welcoming space, and addressing topics that require significant self-reflection might be more easily done in-person. At the same time, however, no evidence was found that communication was hindered in the digitised version, as found by other studies (Boomsma et al., 2018; Ho et al., 2022). For instance, the perception of *Collaboration* and *Team-building* did not suffer, though they were much less frequently mentioned. Nevertheless, the results suggest that the communicators should expect the experience to be somewhat different depending on the platform that is used and that if certain topics, in this case Psychological Resilience, are to be introduced, an analogue rather than digital space would be preferable.

5.2.4 Moderation

The designers and facilitators of Minions of Disruptions™ viewed having limited facilitation as a way to encourage participants to have a positive experience with experiential learning. In game research there are cases being made for those with high levels of moderation (Neset et al., 2020; Marome et al., 2021), autonomous gameplay with a non-obtrusive moderator (Ho et al., 2022; Tsai et al., 2021) as well as games where participants construct either the entire game, or parts of it, themselves (Lankford and Craven, 2020). Minions of Disruptions adopts a largely hands-off approach during the actual gameplay, focusing the facilitation on initial framing and debriefing the experience post-game, and prioritising autonomous gameplay during the session. This proved to be a controversial technique, with some participants praising it and others feeling frustrated and confused.

The participants would have liked to have seen both more and less moderation. For instance, one participant explains: “I liked the energy of the person introducing the game. Then when playing the game leaders did not really explain or introduce the game. They played along and answered questions. After a short while I felt a bit silly saying "I don't understand”. Those who wanted more moderation implied that they were confused by the task at hand, which confirms that experiential learning of games does not work in all contexts and can be itself a form of jargon (Illingworth, 2020). This highlights the need to strike a

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balance, especially with individuals with little experience with games, and explaining the purpose of experiential learning to them prior to the gameplay to reduce the confusion emerging around misaligned expectations.

At the same time, some participants experienced moderation very differently, for instance, according to one participant "It is great that the participants are trusted with the process, and that there is not too much intervention." Those who wanted less moderation, however, felt that the game rules, and especially the externally asserted time pressure, detracted from the quality of their discussions and degree to which they related to the game. This shows an interesting conflict between design intentions, as the time pressure is an important component of creating the game challenge, and generally appreciated by the participants. As discussion is found to be the key to most of the learning in game communication (Neset et al., 2020), it seems that simply more time is needed; which is in line with the argument that the simpler and more familiar the game, the better participants are able to have simultaneous discussions and gameplay (Illingworth and Wake, 2021) .

5.2.5 General public as the target audience

This study refers to the general public as an assortment of highly diverse groups. Their need for information, its reception, and trust toward it is bound to differ (Illingworth and Jack, 2018), and their experiences are difficult to homogenise. The *Climate Science* design intention, which was meant to capture the complexity of climate change, awareness, and urgency aligned strongly in both the online and in-person events. Theoretically, this intention would be closely tied to the *Language* design intention, as accessible language is a key component in expressing the complexity of the topic, yet this design intention was negatively aligned. This might indicate that those who did understand the decomplexified message reported it in the survey and, thus were categorised under *Climate Science* whereas those who struggled to follow referred to *Language.* As one participant reports: “It felt like I was the only outsider and all the others already knew some aspects of the game. There was a lot of jargon.”

Games arguably have the potential to translate scientific knowledge making it accessible for the general public (Gerber et al., 2021). However, designing the right amount of complexity into a game and finding optimal language is challenging as participants should not lose interest, but also not feel overwhelmed (Parker et al., 2016; Flood et al., 2018; Neset et al., 2020). This seems to be amplified when designing for the general public whose experience with games and levels of knowledge are bound to vary. The role of facilitators is important with this audience type; moderation, and particularly its role during debrief, can unpack and explain jargon and tease out connections to real life (Neset et al., 2020). However, even if the discussion design element was connected to almost all design intentions of Minions of Disruptions™, challenges emerged. This could suggest either that moderation/discussion is not performed in a way which would address everyone’s needs, or, as previously found (Flood et al., 2018), that addressing all needs within a short time window might simply be impossible and a series of engagements are needed. To resolve this issue, Neset et al. (Neset et al., 2020) propose that the same game could incorporate different levels of complexity which could be adjusted when needed.

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Regardless, given that the overall reception was positive, this study reinforces the idea that games have a unique ability to cater to different needs. Their ability to engage with diversity, be it in regard to attitudes, perception, behaviour, or cultural values, is what seems to make them so effective (Flood et al., 2018). Immersive experiences are needed to change the way that people relate to climate change (Bekoum Essokolo and Robinot, 2022), and it is encouraging to see that the general public shows eagerness to engage. The method applied here showcases clearly that when a game makes up such a complex package of information and is created to address different cognitive styles by including both textual, audiovisual and kinaesthetic aspects (Flood et al., 2018; Illingworth and Wake, 2021), the audience picks up on different features more strongly. The fact that collaboration was so positively received is an encouraging sign, and demonstrates that games are effective when they create a sense of belonging and purpose for the participants (Illingworth, 2020) facing a shared problem they need to jointly tackle (Den Haan and Van der Voort, 2018). As positive local narratives correlate with the likelihood of action (Den Haan and Van der Voort, 2018), adaptation games such as this one ought to be included in communicators' toolkits.

6 Conclusions

This paper presented a new method to study the designer-participant interaction in adaptation games, which takes a divergent approach to papers that focus on learning, or other analytical frameworks such as psychological distancing theory. Climate change and adaptation are experienced unequally around the world and this paper focuses specifically on communication within communities and organisations where the soft limits to adaptation can be influenced, by reprioritising resources to climate action (O'Neill et al., 2022). From this standpoint, the following key insights were uncovered:

1. Collaboration and Team-building can be strongly recommended as frames for climate adaptation for the general public, as across the dataset they were found to align very well with the way the designers of Day of Adaptation intended. The results show that for the audience in question the actual knowledge shared in the game was less commonly reported as the key aspect, in comparison with the feeling of belonging and experience of solving challenges collectively;
2. Sometimes a game design may incorporate elements, which stand in conflict with each other, meaning that not all the objectives it sets out to achieve are synchronous. In the case of Minions of Disruptions, time pressure is designed within the game to create a metaphor for the climate emergency; yet several participants found that the sense of emergency distorted their ability to discuss and brainstorm with their colleagues. While both of these objectives are important, the facilitator may have to make compromises to achieve one or the other;
3. Measuring both the number of design objectives as well as their relative distribution is important, as it can help the designers identify the stronger and weaker elements of their communication approach. For instance, while Minions of Disruptions effectively communicates aspects such as complexity of the human-environment system, few

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participants related the game to an increase in their Psychological Resilience. If the designers were to incorporate this objective as well, they might have to revisit some of the fundamental design assumptions they drafted.

The reason for implementing a new method comes from the attempt to avoid replicating expert-to-public communication structures, which only focus on the participants as an object of study instead of looking at the whole game experience as a dialogical event (Illingworth, 2020). Knowing if a knowledge-action gap has been bridged is difficult to measure because of the complexity of predicting behaviour, however, participants aligning positively on climate action and reporting feelings of empowerment is a good indication of receptiveness to the messages being conveyed. Developing iterations based on such feedback could further enhance the effect.

This approach is recommended to game designers and evaluators who are interested in discovering which of the messages they aim to communicate are well-received and where distortion takes place, and to simply expand upon the understanding of the needs of those with whom they communicate. While ideally the dialogue with participants is more immediate, this approach was found to be less resource-intensive, and still enabled co-creation, given that the inputs are used to inform future iterations. For instance, here *Collaboration* outshone *Psychological Resilience*, and while both are important messages to convey about adaptation, they might be difficult to fit within one single activity. Insights such as this can help with modifying future iterations of the adopted approach and afford an identity and voice to the recipients of the communication.

The method can be improved in some parts, which could inspire some further research activities. First, if more information were obtained from individual participants, it would be possible to test not only the strongest categories on an aggregate level, but also if a single participant perceives *all* of the design intentions. As it stands, the design intentions were sometimes artificially split, and for instance, the difference between the *Team-building* and *Collaboration* design intentions may have been too nuanced for the realities of a complex three-hour activity. Having higher resolution data would provide deeper understanding of the relationships between the categories, the degree to which the communication experience is different between participants, and what its determinants are. Additionally, having more representative group level data would allow comparison between game events, which would allow studying, for instance, the influence of group size and composition to the reactions.

Moreover, while the focus group gave an idea about which design elements were connected with the intentions, very few participants referred to specific elements, which makes it difficult to say with certainty which specific aspects might have been hindering or facilitating success. This is a limitation and a further inquiry; a potential comparison of different elements aiming to achieve a similar intention would still be needed to understand strengths and weaknesses of specific elements. Finally, the method used to measure participant experience was easily skewed by negative experiences, which was most evident by the frustration with technical difficulties. This is a common issue known to survey research as well, as there is a tendency to report frustration over a session where no challenges emerge. Given the small size of the dataset this could still be considered within the results, as the researchers could look at each entry individually to see what fell under each design intention. If the study were to be scaled-up, a more sophisticated survey could be implemented, which would ask for feedback for all design intentions

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and elements. Ideally the participant experience would be captured during the game events as well, as this would provide a more complete snapshot of the game experience, off of which future tools could be based.

7 Appendices

Table A1. A list of Design Elements Incorporated into the collaborative adaptation boardgame Minions of Disruptions. The categorisation applies frameworks created by Gerber et al. [29], Lankford and Craven [30] and Razali et al. [35] to break down and understand different game types and elements.

Design Element		Description
Abstraction Level: Qualitative Description		A simplified model of the operations of a community/organisation and reality-check cards which connect local knowledge with abstract concepts (e.g. "what measures are in place in your community/organisation in case of a heatwave").
Aesthetic Experience		Implicit messages via colours (e.g. incrementally darker carbon clouds).
Audiovisual Cues		The sound of a car engine implying increasing carbon emissions, in other words, the increasing difficulty level in the gameplay.
Challenge	***Limited funds***	The amount of climate actions that a team can take is dependent on the funds they are in possession of. All teams start with the same amount of funding in the game, but their ability to gather funds depends on their strategic choices.
	Time Constraints	There is limited time to gain resilience; the feeling that time is running out creates a temporarily stressful ambiance and a sense of urgency.
	Uncontrollable Events	There are aspects that players can control (i.e. actions), and that are out of their control (i.e. disruptions).
Character Design		The basic climate action elements are presented as personified characters (Carbions, Climmies and Zillians, or carbon, climate disruptions, and climate action respectively).
Discussion		Players reflect on their experience and share local experiences and knowledge post-gameplay.
Kinaesthetic Experience		The players move around cards, coins and pawns.
Medium	***Board***	The game board illustrates the elements of a community/organisation and visualises GHG emissions and their impact.

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	Cards for Action	Action Cards inject information about possible mitigation and adaptation perspectives.
Moderation Type: Instructionist with Constructionist elements		The game rules are set and explained by facilitators, but the players are to learn the game experientially: no one controls for rule breaks. Players are given the possibility to inject their own knowledge into the game. Game organisers lead the post-discussion.
Player Interaction	***Collaboration/Competition between Teams***	The game is not limited to a single game board but there is a possibility to collaborate or compete between teams to share or mitigate emissions.
	Team Collaboration	Although there are individual player turns, the team may help in decision-making.
Reward		There are no lose-scenarios, and therefore all participants experience successful building of joint community/organisational resilience.
Role Play: Explicit Role Assignment with Optional Roleplay		The participants play as equal members of a community or organisation, most commonly the one they take part in real life. If they so wish, they can also roleplay as a community/organisation that they do not belong in and/or assume characters and character powers which are inscribed by the game.
Tactical Decision Simulation		The players create a unique group strategy to inform their decision-making. Time, disruptions, limited funds and carbon accumulation are elements that make collaboration feel advantageous but also stressful.

Data Availability. This paper makes use of third-party data collected by Day of Adaptation for monitoring and evaluation purposes. Restrictions apply to the availability of these data. Data was obtained from Day of Adaptation and are available from the authors with the permission of Day of Adaptation.

Author Contributions. Conceptualisation, M.Ha., M.H., S.I., and M.S.; methodology, A.M., and M.S.; validation, M.Ha., and S.I.; formal analysis, M.S., and A.M.; investigation, M.H., A.M., and M.S.; data curation M.S.; writing— original draft preparation, M.H, and M.S.; writing—review and editing, M.Ha., M.H., S.I., A.M., and M.S. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest. Authors M.H, A.M. and M.S. have been involved as consultants at the non-profit Day of Adaptation. The sponsors had no role in the design, execution, interpretation, or writing of the study. S.I. is a member of the executive committee of journal Geoscience Communication.

Ethical Statement. This study was carried out according to the British Educational Research Association's (BERA) ethical guidelines for educational research, with all of the data in this study fully anonymised.

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Acknowledgements. The outline for this article was developed in parallel with its pair 'Decreasing Psychological Distance to Climate Adaptation through serious gaming: Minions of Disruptions' (published in Climate Services in December 2023), as two separate research questions emerged from the data gathered from Day of Adaptation's monitoring and evaluation effort. One of these questions related to the tangible impact of the game, which is assessed through the lens of psychological distancing in the aforementioned journal article. The other question, which deserved a reflection of its own, is the theme of this paper, namely how could such tangible impact be achieved by communicators, and which elements of multifaceted game-based communication would most readily be received by the public. To give space for the investigation of both research questions, two separate research teams were set up with the purpose to allow for broader reflections and make space for diversity of knowledge. While one of the datasets used in these two separate studies is largely looking at the same body of participants, the methods and angle through which the dataset is inspected diverge significantly.

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