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A study with graphic in designers about climate change communication

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Abstract
Communication for action about climate change is difficult to operationalize. Capturing attention and motivating action requires understandable scientific data. We developed and tested a tool to boost graphic designers' ideation.We crossed communication objectives, the nature of content and conditions for visual communication with the need to capture attention, promote risk perception and motivate action. We conclude that the design of graphic communication objects may need to go beyond the use of images, the data-driven narratives and individual testimonies. Understanding human causes of climate change needs a multidisciplinary approach to the traditional graphic design project field with visual communication strategies that integrate existing knowledge.

Keywords
Graphic design; visual communication; climate change; risk perception; ideation

Un estudio con gráfica en diseñadores sobre comunicación sobre el cambio climático

Resumen
La comunicación para la acción sobre el cambio climático es difícil de poner en práctica. Captar la atención y motivar la acción requiere datos científicos comprensibles. Desarrollamos y probamos una herramienta para impulsar la ideación de los diseñadores gráficos. Cruzamos los objetivos de comunicación, la naturaleza del contenido y las condiciones de la comunicación visual con la necesidad de captar la atención, promover la percepción de riesgo y motivar la acción. Concluimos que el diseño de objetos de comunicación gráfica puede necesitar ir más allá del uso de imágenes, narrativas basadas en datos y testimonios individuales. Comprender las causas humanas del cambio climático necesita un enfoque multidisciplinario del campo de proyectos de diseño gráfico tradicional con estrategias de comunicación visual que integren el conocimiento existente.

Palabras clave
Diseño gráfico; comunicación visual; cambio climático; percepción del riesgo; ideación

Introduction

Climate change is a key concern for most people, with differing opinions on how the challenge should be addressed in terms of both individual and global impacts (Narawad, 2023). Public understanding of the phenomenon remains a challenge that requires effective responses, with not only the scenario of lack of information, but also hard-to-access information and misinformation remaining prevalent. These conditions lead to misconceptions about what climate change is, making it difficult to tackle it adequately. The public's understanding of climate change has a decisive influence not only on the acceptance of measures, but also of risk management procedures (Horta & Carvalho, 2017). Recent evidence shows that people are willing to act while being pessimistic about the attitudes of others, creating a "state of pluralistic ignorance" (Andre et al, 2024). This state has a chilling effect on action as there is a perception that there is a lack of support from others; communication efforts are needed to correct this discrepancy. Raising public awareness has been identified as a priority in communication, with a focus on how to better communicate about climate change in order to take action (Moser, 2016). In climate change communication research, how to make the wealth of research accessible and usable for communicators to achieve the desired impact is a key challenge (Cannon, 2022a). The narrative formats of messages, the interaction and the recognition of the role of emotions in their affective, emotional and cognitive dimensions are insights that research brings to the practice of climate communication. Studies show that information conveyed in graphics designed according to best design practices and utilizing the full potential of visual expression of forms increases the perception of credible knowledge and risks related to climate change (Courtney & McNeal, 2023). The message about the risks must be clearly communicated so that the public understands the data as well as its implications in order to trigger action in the form of active participation in decision-making to mitigate these risk situations (Ferreira, Cordeiro, 2016). The visual stimuli as a means of achieving public risk perception implies the consideration of the facts about climate change as a human cause, the acceptance of the scientific consensus, the recognition of the credibility of science and scientists and also the recognition of the effectiveness of climate change actions (O'Neill & Nicholson-Cole, 2009).

Belief in the human cause of climate change is considered a strong predictor of public concern. However, belief in the anthropogenic cause makes the approach to the problem more complex, as a higher level of associated risk is perceived (Gregersen, 2022). People's actions not only depend on emotions to trigger attitudes and behaviors, there are also other factors that can influence them. The link between the effects of climate change and natural environmental changes is still part of beliefs. When the human cause of the negative consequences of climate change is understood, it is responsible for a high level of concern (Gregersen, 2022). But it is what people imagine the effects of climate change to be in their concrete reality, at the local level in their country, that determines their concern. A person's political orientation also influences perception, which in turn has a strong impact on behavior (Gregersen, 2022). There is a relationship between beliefs and concern that is influenced by these dimensions and affects the perception and impact of awareness messages that shape the public's understanding of climate change. Research suggests that climate change is viewed as something broader and more complex, with public concern being a central factor in defining a mental model of climate change (Gregersen, 2022). Communication about climate change is as much about communicating scientific knowledge as it is about social systems (Canon, 2022a). This is the working framework of communication, a demanding and at the same time challenging framework, especially with regard to the process of faith formation.

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The construction of meaning construction in climate change visual communication

The power of visual communication is very important to promote perception to motivate people and lead them to act. Communicating scientific knowledge based on the visualization of graphics reduces disbelief by 50%, which actually has an important impact on eliminating political polarization around the issue, an aspect that is of great importance in some countries (Van der Linden, 2017). In a message images can trigger a feeling in the individual that he can do something about climate change, which means they are motivated to act (Uka & Uka, 2022). There's an important link between information and action in communication before the feelings of fear, guilt, indifference or denial experienced in climate change challenges (Ferreira et al, 2023). However in climate change the "fear trend" was understood to drive people away, generating feelings of concern and appre-

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hension (O'Neill & Nicholson-Cole, 2009). Studies show that exposure to negative images about climate change negatively influences the perceived effectiveness, in contrast, the use of positive images, such as solutions, influences perceptions of the effectiveness of action (P. Sol & Lauren, 2016). Negative images lead to an overall slowdown in reaction time and positive images may be more conducive to pro-environmental behavior (Carlson et al, 2020).

Before the importance of public perception, barriers to the construction of meaning in climate change communication are important obstacles related to the intrinsic nature of the phenomenon and the limits of human perception, as well as the communication models that have dominated so far (Lopes, 2022). People's inaction may be related to these limits of human perception, which reflect the ambiguity and uncertainty that communication aims to address (Lopes, 2022 and Morris & Pickering, 2019). These aspects impact public understanding and require knowledge not only of effective communication but also of human behavior. When it comes to a cause that is considered "invisible", i.e. abstract due to the psychological and geographical distance of its events, which are far removed from people's daily experience and lifestyle, the challenge of constructing meaning becomes extremely important. even more crucial. The power of image can influence emotions, which can affect personal beliefs. However, more research is needed on the visual dimension in climate change communication, i.e. its power in promoting lifestyles and training for action in an area where the verbal still predominates to the detriment of the visual (Lopes, 2019).

Visual presentation of information

Visual communication plays a very important role in making climate change "tangible", facilitating access to data that is difficult to understand. The care with data presentation captures attention and the high quality of visuals will be understood with confidence by the audience, eliminating the lack of reliance associated with simpler graphics (Courtney & McNeal, 2023). The visualization of information with humanized data is very important for engaging the public in messages carefully directed to the audience and making it possible to appreciate scientific information (Ferreira et al, 2023). This data appreciation is more important for communication with the public than investing in an in-depth understanding of scientific data. Public perception increases before accessible communication, and it is very useful for awareness about climate change, influencing policy decisions and ultimately reducing the damage caused by climate change. Visual content tends to be remembered, especially when there is incoherence, reducing interpretative complexity based on communication that mixes facts and narratives. As cultural objects, images, even when it comes to data visualization, portray objective reality as frames that allow understanding (Lopes, 2022). Cultural cognition based on perception sets in movement mechanisms that influence individuals' beliefs and promote acceptance. (Courtney & McNeal, 2023)

Human bias. Attention is currently one of the most challenging aspects of climate change communication, threatening the possibility of a successful communication. We can not forget human cognitive bias responsible for the ability to maintain attention, to the importance of a topic and to understanding. The attentional and perceptual bias must be taken into account in communication, both in message formulation and visualization (Luo & Zhao, 2021). This is a realm where images can play a highly relevant role (Carlson et al, 2023). Addressing the challenge of communicating about climate change while considering the complexities associated with individual audience differences involves understanding the importance of the beliefs of the recipients of the message to promote perception and motivate action, and attention is the starting point. Knowing the medium of the message and its relevance for attention and perception is crucial as the dynamics resulting from the interactions between peoples and its context, for communication that solves the gap between beliefs about others willingness to act and preoccupation and individual and collective behavior.

Designing climate change communication

Making sense to the public is at the center of climate change communication which means approaching such kinds of complex problems in a collaborative mode between knowledge areas, integrating large amounts of data about reality. The design solutions imply the master of powerful tools like research and analysis methods for understanding, despite the designers' cognitive strategies are still understood in the realm of speculation and subjectivity. Thinking visually designers do not separate problem research and solution creation, they co-evolve, with a particular focus on the solution. We consider design as a process of learning-knowing creative heuristic due the nature of designers' mental activity, condition for discovery and invention (Maia, 2023). The design process

is dominated by the interactions with the materials of a design situation with thoughts and actions. The construction of a solution is a relatively free activity with analysis and synthesis, often pointed out to be too intuitive and informal embracing subjectivity, in contrast to more formal approaches. The work of conceiving a solution arises from a diffuse idea of a possibility for a solution, in an initial *ideation* phase, to a clear configuration. This process depends on a person and also on the environment as well as on the characteristics of the task itself. Defining *how things can be* and *make them real* means imagination and invention, accepting a non-linear and non-predictable way of thinking and acting in a design process.

Issues to overcome in the communication design challenge

The visualization of climate change information can help to understand complex concepts and imagine future scenarios. However the relationship between the impact of a visual stimulus and the motivation for changing behavior still needs more research. Knowledge about the overcoming of that gap between what we are willing to do and the belief about others' motivation depends on our perspective on answers about how climate change can become more closer to individual everyday life. Identifying the variables in visual communication that can effectively capture public attention to climate change will determine the kind of stimulus capable and appropriate to draw attention to the topic (Carlson & Coughtry-Carpenter, 2023 and Ferreira et al, 2016). The creation of concrete climate communication images is a demanding challenge because of the distance of the issue, with mental imagery made of diverse levels of emotion and concern (Horta e Carvalho, 2017). Climate change communication may have to seek support in the aspirational potential of visual communication for redirecting the concern to accomplish collective engagement. Understanding the mechanism underlies the predisposition to pro-environmental behavior can be helpful to decide which images are more likely to sustain attention of the public (Carlson et al,2020).

The definition of concrete guidelines for communication must eliminate the gap between science and public understanding. Applying knowledge about climate change communication practice is more than overcoming the information deficit, communication needs more sophisticated approaches, and is more complex than simply providing information (Horta & Carvalho, 2017). The creation of communication materials that are factually correct and easy to understand for the public is something different from the idea of scientific literacy as a way to improve public engagement (Morris & Pickering, 2019). In visual communication, thinking about form and content of messages, considering choosing words and images for different audiences demands knowledge about human perception and its limits.

Empirical study

The disconnection between research and communication practice is characterized by the difficulty of applying knowledge (Cannon, 2022a). Although studies on visual communication are still necessary, existing knowledge is useful and the opportunity to apply it must not be missed. In an effort to contribute to the connection between theory and practice in climate change communication, we conducted a qualitative study with *designers observation in action,* with final year students of graphic design higher studies. The objective is understanding the influence of knowledge on visual communication on climate change in the definition of visual concepts and ideas to be developed, i.e. in the ideation phase of the design process. We formulated as a research hypothesis whether for designers the plan to follow in the conceptualization of communication objects that consider *capturing public attention, promoting risk perception and motivation for action* can be boosted with a framework that encompasses research. Considering the following research questions: How designers use this framework? The designers incorporate in the process the research knowledge covered by the framework? Is this framework considered relevant to the process by the designers?

This study was based on a tool developed to promote ideation. This tool was fed with existing knowledge, in studies on the ability of images to engage the public (Courtney& McNeal, 2023) (Carlsonet al, 2020) (Boomsma et al, 2016), on the production of meaning (Cannon, 2022a), on attention and motivation to act (Chapman et al, 2016) (Courtney & McNeal, 2023), on the role of images in perception and behavior (P. Sol & Feldman, 2016) (Ferreira et al, 2023), on the graphic quality of communication and the credibility of information (Morris & Pickering, 2019) (Courtney & McNeal, 2023), on how to communicate better visually, and on eliminating the distance between communication science and practice (Courtney & McNeal, 2023). The study was carried out with graphic design students, with a sample of 32 participants, male and female, with ages from 20 to 25 years old, in the final phase of completing

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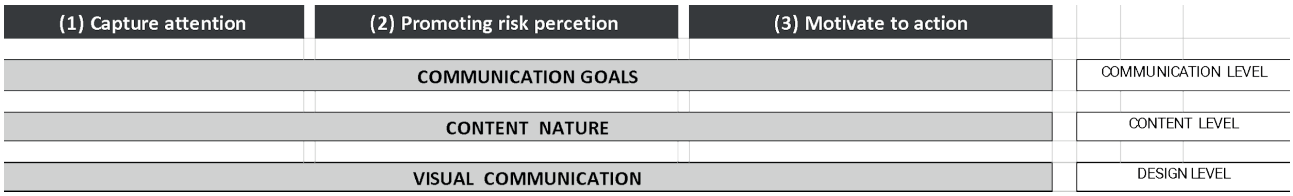

Figure 1: Structure of the *Ideation Booster Board*. Note: Copyright 2024 by Manuela Maia

their higher education courses. The students were asked to begin a design process in teams to create a concrete visual communication object, a poster. During the process, data was collected on the performance of the task, in particular on the influence of the tool on the formulation of visual concepts and the development of ideas.

Methodology

A qualitative methodology supported by data collection through a questionnaire that was answered during and after the work session, using the Likert scale for some answers. Direct observation of design students in action was also conducted using an observation guide to understand how this tool was used to support idea generation.

The Ideation Booster Board. The basic structure of this tool consists of three levels of approach to the design of the communication object: the communication level, the message level and the design level, which includes the communication objectives, the type of content and the guidelines for visual communication. The structure was completed with three components that the poster must fulfill: (1) attract attention, (2) promote risk perception and (3) motivate action (figure 1).

This structure supports the knowledge that is a working guide, the type of requirements that must be met by the solution, with students having the freedom to opt for simpler or more ambitious approaches that can integrate the entire content of the board (figure 2). The content is presented on the board in cells and serves as a stimulus for idea genera

Analysis protocol and analysis units. A work protocol was established to achieve the objectives of the study and a two-phase workflow was defined. A first preparatory phase consisted of an initial selection of the topic of the problem to be addressed, the communication context and the target group. Secondly, the teams were prepared for the use of the tool. Exploring the panel from the first level, the *communication objectives*, the teams made their decisions until they had completely covered the three levels. In doing so, they were guided to make decisions on how to raise awareness, promote risk perception and increase motivation for action. Each team finished this second moment of preparation by defining their own *Ideation Booster Board* (Figure 3). After the preparation, the second phase of the session began, the *ideation* phase to create the communication object.

Discussion of results

From the analysis of the data collected from the individual responses to the questionnaire during the first phase of the working session, we can verify that 75% of the students, who formed the sample of thirty-two participants, consider the issue of climate change to be “extremely important”, while the rest consider it to be “important” and “very important”. The role of the designer in climate change communication is considered “extremely important” by 56.52%, “very important” by 10% and “important” by the rest. These results allow us to infer the importance of the designer’s role in communicating about climate change for this group of students. However, by observing the students’ behavior in action, it was possible to understand in the dynamics of teams and in the dialogue between peers, participation in tasks and leadership of the work and/or the team, that the topic may be more attractive to some than to others. Students’ responses about the usefulness of the *Ideation Booster Board* at the end of the second phase show that they consider it “very useful” for developing ideas considering the content (89%). When asked if the challenge provided them with applicable knowledge for designing graphic solutions in climate change communication, 93.75% of the students answered “yes”. When asked if they would like to develop more design skills in relation to this action communication, 81.25% answered “yes”. These results allow us to deduce about the usefulness of knowledge in practice through the use of a tool with structured and organized knowledge for this group of students. These conditions can also be verified by observation, not only by understanding how the tool works, but also by its

	(1) Capture public attention	(2) Promoting risk percetion	(3) Motivate to action
COMMUNICATION GOALS	importance of the issue	data salience	connect data and action
		data credibility	perception of action eficacy
		science and scientists credibility	
	human cause awareness	appreciation of data	elimination of theme abstraction
			personal connection with the topic
			perception of action eficacy
CONTENT NATURE	emotional	humanized data	share positive experiences
	affective	understandable data	
		messages of hope and participation	personal stories
	cognitive	data driven narratives	
		short explanatory texts	CC mitigations solutions
VISUAL COMMUNICATION	emotionally positive images (CC mitigation solutions, ex. solar panels)	strong images /easily memorables (CC mitigation solutions)	local context references
		aesthetics (simplicity)	global / local influential personalities
	easy recognizable colors	color codification data	microdata
	psycology of shapes (enable visual perception)	concepts illustration	storytelling
		simple presentations	daily life pro-enviromental behaviors guidelines
		familiar formats data presentations	
		graphic quality	
	images + text proportion (50-50)	synthetic text (direct speech)	message framing

Figure 2. *Ideation Booster Board*. Note: Copyright 2024 by Manuela Maia.

effective use in idea generation. However, upon observation, we found that although some teams completed the first phase without difficulty, they began an ideation process in the second phase, moving away from their *ideation booster board* and engaging in more intuitive behavior by selecting and discarding options.

Conclusions

We believe that with this study it is possible to draw conclusions for future developments. However we are aware of the limitations of the study, not only due to the sample size, but also due to the conditions under which it was carried out. The data was collected in a simple and direct way, as well as its presentation, which were subject to analysis and discussion without considering their treatment and respective statistical analysis. Despite all the aspects regarding the limitations mentioned, we believe that the results provide us with insights about the importance of eliminating the distance to scientific knowledge on climate change communication in the practice of visual communication, as far as the ideation phase of a design process is concerned. Based on the discrepancy between the results of the survey on the perception of the applicability of knowledge in this specific situation provided by the tool used and the behavior observed in some teams during ideation, we can assume that the approach to the problem of effective climate change communication was complex for this group of students. A multidisciplinary

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	(1) Capture public attention	(2) Promoting risk percetion	(3) Motivate to action
COMMUNICATION GOALS	importance of the issue	appreciation of data	connect data and action
CONTENT NATURE	emotional	humanized data	personal stories
VISUAL COMMUNICATION	easy recognizable colors	simple presentations	microdata

Figure 3: Example of a possible *Ideation Booster Board* of a team. Note: Copyright 2024 by Manuela Maia

approach to the communication process involved in the design of a concrete graphic communication object for climate change might be necessary. We assume some speculation from this brief study with this group of students that the field of graphic design projects needs a strategic framework for climate change communication that is rich in knowledge, but the conditions for its application must not be in the hands of designers alone. From our perspective, the insights gained from this study allows us to point out as a recommendation the need to carry out more in-depth studies with designers in action, collecting data with statistical significance for their adequate analysis in order to allow conclusions that bring knowledge about the role of designers in climate change communication. The reflection promoted by this work leads us to consider that graphic design could be challenged beyond its traditional boundaries in visual communication for climate change. The still limited knowledge about the effective role of the visual dimension in climate change communication is an obstacle that needs to be overcome for a deeper understanding of these conditions.

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