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ORIGINAL ARTICLE

From Abstract to Applied: How Language Sophistication Shapes Creative Ideation for Novel Technologies

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ABSTRACT

Understanding and creativity are intertwined cognitive processes that shape ideation and innovation potential in interdisciplinary teams. This article investigates how varying levels of language sophistication shape students' conceptualizations of technology, guiding them toward either high-level abstract reasoning or concrete, domain-specific thinking. Through an experimental design involving 63 participants from diverse academic backgrounds, we examined how simplified, intermediate, and technical explanations of terahertz sensing technology affected participants' cognitive focus and creative application generation. Our findings demonstrate that language sophistication manipulates psychological distance and construal level: simplified explanations induce high-level construal leading to benefit-focused understanding and abstract applications, while technical explanations induce low-level construal resulting in mechanism-focused thinking and domain-specific ideas. Technical language also creates cognitive fixation effects that constrain cross-domain creativity, while abstract language serves as an effective de-fixation strategy. Intermediate complexity explanations yielded optimal ratings for perceived technological potential, suggesting a balance between accessibility and depth. Based on these findings, we propose a staged ideation model that strategically sequences language complexity to harness both divergent and convergent thinking processes. This research extends Construal Level Theory into innovation management contexts and provides practical tools for optimizing creative processes in interdisciplinary environments.

Keywords: Understanding; Creative Ideation; Construal Level Theory, Cognitive Fixation, Psychological Distance, Innovation Management, Interdisciplinary Teams.

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INTRODUCTION

Understanding is not a monolithic construct; it is layered, dynamic, and multifaceted. These layers range from basic comprehension to deep, abstract insights, each contributing differently to the creative process (Orwig et al., 2024). As we engage with complex technologies, the way we understand and reformulate these concepts can profoundly influence our capacity for innovation (Hargadon & Bechky, 2006).

Reformulation, the practice of translating complex ideas into more accessible terms, sits at the heart of interdisciplinary collaboration. While reformulation can democratize knowledge across disciplinary boundaries and foster creativity by making specialized concepts accessible to team members from different fields, it may also impose cognitive limitations, leading individuals to anchor their thinking around simplified representations and thus limiting the scope of novel ideas (Maier et al, 2021). Empirical studies of interdisciplinary and design teams document both the productivity gains and the communicative frictions that arise when teams with heterogeneous knowledge attempt synthesis, indicating that negotiation of language and boundary concepts requires active facilitation (Mulder et al., 2021).

This issue is especially relevant in interdisciplinary innovation teams, such as those found at CERN IdeaSquare and similar research environments, where collaboration depends on integrating diverse expertise (Joore et al., 2022). These teams often face communication challenges rooted in differences in disciplinary background, levels of expertise, and the reliance on specialized jargon (Mulder et al., 2021). Linguistic choices in explaining emerging technologies can therefore play a crucial role: they may act as bridges that enable shared understanding and cross-pollination of ideas. Language, as the primary medium through which ideas are structured and shared, exerts a profound influence on how new technologies are perceived and imagined. The sophistication of language, including its degree of precision, abstraction, and technicality, can either enhance clarity or obscure meaning (Caccamo et al., 2023). Within interdisciplinary contexts, simplified language may facilitate accessibility across backgrounds, but risks cutting away the conceptual richness needed for truly innovative applications. Conversely, highly technical language may deepen understanding for experts while alienating non-specialists, thereby restricting the scope of collaboration.

In this paper, we investigate how different levels of language sophistication in the explanation of a technology influence the creative process. Specifically, we examine how varying the complexity of explanations of terahertz sensing technology shapes participants' understanding and their ability to generate creative applications.

By positioning *reformulation strategies* as the key cognitive mechanism in this process, we aim to illuminate how linguistic choices can be tailored to balance accessibility and depth in interdisciplinary innovation teams.

This study aims to explore the following research questions:

1. How does the complexity of language used to describe a technology influence participants' understanding?
2. What impact does this understanding have on their ability to generate creative applications of the technology?

THEORETICAL BACKGROUND

1. Understanding, Creativity, and Innovation: Foundational Relationships

Creativity is defined as the ability to generate ideas that are both original and effective (Runco & Jaeger, 2012). This cognitive process is deeply intertwined with understanding, which encompasses both surface-level comprehension and deeper conceptual insights (Finke, Ward, & Smith, 1992; Green et al., 2024). Innovation extends this relationship by focusing on the practical implementation of creative ideas to produce novel solutions for real-world challenges (Amabile, 1996; Ceko, 2023).

The relationship between understanding and creativity is not linear. While basic understanding provides the foundation for creative endeavours, it is often deeper, more conceptual understanding that enables individuals to make connections between disparate ideas and generate truly innovative solutions (Ward, 2007; Weisberg, 1999). However, this relationship is modulated by cognitive processes that can either facilitate or constrain creative thinking, particularly in how information is mentally represented and processed (Orwig et al., 2024).

2. Construal Level Theory: The Cognitive Mechanism of Distance and Abstraction

Construal Level Theory (CLT) provides a powerful framework for understanding how the mental representation of information influences creative thinking (Trope & Liberman, 2003, 2010). According to CLT, psychological distance, whether temporal, spatial, social, or hypothetical, fundamentally alters how individuals mentally represent events, objects, and concepts, creating two distinct modes of cognitive processing.

When information is psychologically distant, individuals engage in high-level construal, characterized by abstract, schematic mental representations that focus on essential features, overarching purposes, and the fundamental "why" of phenomena (Liberman & Trope, 1998). This abstract processing mode enhances creativity by enabling broader categorization across seemingly unrelated domains, facilitating divergent thinking that generates multiple varied solutions, and reducing constraints imposed by surface features that might otherwise limit ideation to obvious applications (Förster, Friedman, & Liberman, 2004; Jia, Hirt, & Karpen, 2009; Wakslak & Trope, 2009). Recent empirical evidence reinforces this: for instance, Zhang et al. (2025) show that greater psychological distance enhances originality in idea selection, mediated by higher construal levels.

Conversely, when information is psychologically proximal, individuals engage in low-level construal, focusing on concrete details, specific mechanisms, and the practical "how" of phenomena (Trope & Liberman, 2003). This concrete processing mode facilitates detailed feasibility assessment through careful evaluation of practical constraints, enables the application of domain-specific expertise by activating relevant specialized knowledge, and promotes convergent thinking that guides systematic problem-solving within well-defined parameters (Andrade-Valbuena et al., 2024). While this mode may constrain the breadth of idea generation, it enhances the precision and applicability of solutions within specific domains.

3. Language Sophistication as a Manipulation of Psychological Distance

The experimental manipulation in this study, varying language sophistication from simple metaphorical descriptions to technical jargon, can be understood as a direct manipulation of psychological distance and, consequently, construal level, as supported by recent research (Zhang et al., 2025).

Abstract Language and High-Level Construal: Simplified, metaphorical explanations (e.g., describing sensors as "little trampolines") create psychological distance from the technical reality of a technology. This abstraction induces high-level construal, prompting participants to think broadly about overarching purposes and potential benefits (Mueller et al., 2025). The cognitive distance from technical specifics facilitates divergent, exploratory thinking about novel applications.

Technical Language and Low-Level Construal: Precise, jargon-laden explanations force participants into psychologically proximal engagement with technical details. This proximity induces low-level construal, compelling focus on specific mechanisms, constraints, and feasibility considerations (Mueller et al., 2025). The cognitive proximity to technical specifics facilitates convergent, detailed analysis within domain boundaries.

4. Cognitive Fixation: How Prior Knowledge Constrains Creativity

Cognitive fixation represents a well-documented barrier to creativity where prior knowledge, examples, or activated schemas constrain idea generation, creating mental boundaries that limit exploration of novel solutions (Smith, 2003). This phenomenon is particularly relevant to understanding how language sophistication influences creative processes, especially when individuals possess varying levels of domain expertise, shown by recent empirical work (Frith et al., 2022; Wang, Okada & Takagi, 2023).

Functional fixedness, first identified by Duncker (1945), describes the inability to perceive novel uses for objects beyond their conventional purposes. In technological innovation contexts, this manifests as design fixation, where exposure to specific examples or technical details constrains individuals to think within narrow solution spaces (Jansson & Smith, 1991). Paradoxically, expert knowledge, while generally advantageous for problem-solving, can lead to cognitive rigidity by activating well-established mental schemas that limit exploration of unconventional applications. This occurs because expertise creates what Wiley (1998) termed "mental set", a predisposition to approach problems using previously successful methods, thereby constraining creative exploration (Wang, Okada & Takagi, 2023).

Technical language and precise terminology function as powerful cognitive primes that activate specific knowledge schemas in individuals with relevant domain expertise. While this activation enhances accuracy and enables sophisticated domain-specific application generation, it simultaneously constrains ideation to familiar conceptual pathways. The phenomenon mirrors Luchins's (1942) "Einstellung effect," where individuals become mechanized in their problem-solving approaches, applying familiar solutions even when novel approaches might be more effective. In the context of technological explanation, sophisticated technical language may trigger these constraining effects, channelling creative thinking into established domain boundaries. Such priming effects are in line with findings from neurocognitive studies: Frith et al. (2022) demonstrated that when prior knowledge is strongly activated (e.g., via examples or schema-relevant cues), the neural representation shows reduced flexibility and increased interference, thereby limiting creative recombination.

On the other hand, abstract, metaphorical language serves as an effective de-fixation strategy by circumventing the activation of constraining mental schemas. When technical concepts are presented through simplified explanations that avoid domain-specific jargon, individuals approach the technology without the cognitive baggage of preconceived notions about appropriate applications (Smith, Ward, & Finke, 1995, Wang, Okada & Takagi, 2023). This cognitive "freshness" creates conditions conducive to cross-domain thinking and enables individuals to generate more diverse creative solutions that transcend traditional disciplinary boundaries.

5. Reformulation Strategies and Creative Ideation

The process of reformulation, translating complex technical concepts into alternative linguistic forms, emerges as a critical intervention point for influencing creative outcomes. Different reformulation strategies create distinct cognitive conditions that systematically bias thinking toward either divergent exploration or convergent refinement as highlighted by recent studies (Chang & Kuo, 2024; Yu & Nagai, 2025).

This theoretical framework suggests that the optimal approach to fostering innovation may not be a single level of language sophistication, but rather a strategic sequence that leverages the cognitive benefits of different construal levels. Such an approach would harness abstract language's capacity for divergent exploration while utilizing technical language's precision for convergent refinement and feasibility assessment.

6. Integration with Established Innovation Frameworks

The proposed relationship between language sophistication and creative thinking aligns with established innovation methodologies. Design Thinking processes explicitly move from broad empathy and ideation phases (analogous to high-level construal conditions) to focused prototyping and testing phases (analogous to low-level construal conditions) (Brown, 2008). Similarly, Stage-Gate models use progressive filtering mechanisms to move from broad idea generation to detailed feasibility analysis (Cooper, 1990).

The novel contribution of this research lies in identifying language sophistication as a practical lever for guiding teams through these cognitive transitions. Rather than relying solely on process structure, strategic manipulation of explanatory language can induce the cognitive states most conducive to each phase of innovation.

METHOD AND DATA

Study design

To explore the relationship between language sophistication, understanding, and creativity, this study employed a between-subjects experimental design focused on how individuals interpret and generate ideas about a terahertz sensing technology known as H-cube, which has significant potential for diverse applications (ATTRACT, 2021).

The independent variable was language sophistication, manipulated at three levels (basic, intermediate, advanced). Participants were randomly assigned to read one of three versions of the same technology description, which differed only in their linguistic complexity.

The study examined several dependent variables, each corresponding to a specific cognitive outcome of interest:

1. Conceptual Understanding – how accurately and coherently participants grasped the core principles of the technology.
2. Reformulation Ability – the extent to which participants could translate the technology into alternative explanatory forms.
3. Creative Ideation – measured in terms of the fluency, originality, and diversity of applications generated.
4. Perceived Future Potential – participants' evaluative judgments of the technology's promise, operationalized through enthusiasm ratings.

These dependent variables were operationalized through four corresponding tasks:

1. Participants reformulated the explanation of the technology.
2. They identified the key points of the technology.
3. They generated possible real-world applications.
4. They reported enthusiasm ratings for the technology's perceived future potential.

Participants

Participants were selected from various universities and technical institutions, ensuring a mix of students from engineering, business, and natural sciences backgrounds. Recruitment was conducted by distributing a link to the online survey through WhatsApp. This approach yielded a sample group of diverse academic backgrounds, reflecting the variety of perspectives present in innovation settings. In total, N=63 participants took part in the research and were randomly assigned to one of three groups: Group 1 (basic) n=20, Group 2 (intermediate) n=23, and Group 3 (advanced) n=20. A full overview of the number of participants according to background can be found in Table 1.

Materials

The materials consisted of an online survey that integrated both the experimental manipulation and the subsequent questions. The manipulation consisted of one of three audio clips, ranging from 45 to 60 seconds, containing the same core information about the H-Cube technology, but varying in linguistic sophistication (**SUPP 2**). Following the audio, the participants answered a series of questions related to the H-Cube technology (**SUPP 1**).

Table 1: Participant academic background and group allocation

Characteristic	Group 1 (Basic)	Group 2 (Intermediate)	Group 3 (Advanced)	Total
Number of participants	20	23	20	63
Academic background				
Aerospace engineering	9	9	7	25
Computer science	4	2	2	8
Applied mathematics	1	3	0	4
Applied physics	1	2	1	4
Electrical engineering	0	0	2	2
Architecture	0	0	0	0
Economics	0	1	1	2
Business administration	0	2	0	2
Humanities	1	1	0	2
Biology	2	0	2	4
Communication studies	0	0	0	0
Law	0	1	0	1
Other	2	2	5	9
Technical background (%)	85.0%	73.9%	70.0%	76.2%

Procedure

The study was administered through an online survey with the following procedure. Upon opening the survey, participants were presented with a description of the study's purpose: "This survey aims to aid our research into how the mode of presentation and the ideation process correlate. To this end, this survey contains a recording about a technology developed at CERN, H-Cube. Following this recording is a series of questions, often found during the ideation process." The participants then reported their field of expertise. They were then presented with a one-sentence description of the H-cube technology: "With H-Cube, we know how to cheaply and portably capture light that is not visible to the human eye." and asked to write down what came to mind. Subsequently, participants were presented with a link to one of three 45-60 second audio explanations of the H-

Cube technology. After listening to the assigned audio clip, participants answered a series of questions which prompted them to (1) explain the technology in their own words, (2) list the key points of the H-Cube technology, (3) write down any applications of the H-Cube that come to mind, and (4) rate their enthusiasm for both the technology and their proposed application on a Likert-type scale.

Data Analysis

Qualitative Analysis

Open-ended responses were coded using a rubric (**SUPP 3**). For the question regarding the key points of the technology, the answers were classified into four categories: (1) No understanding of the technology, (2) emphasis on the physical workings behind H-Cube, (3) emphasis on the advantages relative to similar technologies, and (4) combination of both the mechanism and advantages of the H-Cube. The grading scheme is provided in SUPP 3. Inter-reliability was assessed using Cohen's Kappa and was found to be acceptable ($\kappa = 0.65$).

Quantitative Analysis

For the questions that were graded on the Likert scale, ANOVA was used to compare the means across the three groups. When ANOVA indicated significant differences, post-hoc pairwise comparisons were conducted with t-tests, and the resulting p-values were adjusted using false discovery rate (FDR) corrections to control for multiple testing. For the categorical response types related to the key points of the H-Cube, a chi-squared test of independence was applied to assess whether distributions varied significantly between groups, and effect sizes were calculated to evaluate the strength of these associations.

RESULTS

In this section the results of the survey will be presented. Firstly, the differences between groups regarding the key points of the technology will be presented. Subsequently, the differences in types of applications between groups and students will be highlighted. This section is finished by showcasing the self-perceived enthusiasm of participants across the different groups.

Key points of the technology

The responses of the participants to the question "What are the key points of the technology", were analysed as described in the methods section and classified into four categories: (1) No understanding of the technology, (2) emphasis on the physical workings behind H-Cube, (3) emphasis on the advantages relative to similar technologies, and (4) combination of both the mechanism and advantages of the H-Cube. A numerical summary of the results is presented in **Table 2**. To investigate whether the distribution of response types differed across the groups, a chi-squared test of independence was conducted. The test indicated no statistical differences in response type distribution, $\chi^2(6, N = 63) = 10.75$, $p = 0.097$, Cramér's $V = 0.21$. Although not significant, a p-value of 0.097 and effect size of 0.21 suggest a possible trend toward a small-to-moderate association between language sophistication and response type. Such a trend can for instance be observed in **Table 2**, where group 1 showed to have a higher proportion of participants focussing on the benefit of the technology whereas in group 3 a greater proportion of participants emphasized only the physical mechanism behind the technology.

Table 2. Distribution of qualitative response type for "Key points of the technology"

Response type	Group 1 (Basic) (%)	Group 2 (intermediate) (%)	Group 3 (Advanced) (%)
No understanding	15.0%	10.9%	17.5%
Physical mechanism emphasis	17.5%	21.7%	42.5%
Benefit emphasis	55.0%	57.8%	32.5%
Physical mechanism and benefit emphasis	12.5%	19.6%	7.5%

Technological Applications

The proposed applications for the H-Cube varied in their level of abstraction and sophistication across groups. For group 1, receiving information with the lowest level of language sophistication, the applications were characterised by a high level of abstraction. For example, one participant suggested 'artsy photos, research about terahertz light emission', while another proposed 'An alternative to x-rays, or some kind of metal detector but for fancier things', and yet another participant 'Detection of rays.' In contrast, applications from group 3 showed greater technical specificity and were often linked to the participants' domain of expertise. Illustrative examples include 'microparticle detection or microprotein detection' from a participant in biology, and 'Space applications - detection of low-intensity waves to image celestial bodies. Communications - sending and receiving high-bandwidth data through high energy waves' by an aerospace engineer.

Enthusiasm about the technology

The mean Likert-scale ratings across groups and results of the one-way ANOVAs are displayed in **Table 3**. The results show that there is no significant difference in excitement about the H-Cube technology ($p = 0.125$) as well as excitement about their own applications (p=0.188). However, for the question regarding the perceived future potential of the H-Cube, it was found that there was a significant difference in excitement between at least two of the groups (p = 0.004). Follow-up t-tests with false discovery rate (FDR) corrections revealed that there was a significant difference between group 1 and 2 (p = 0.004), while no such difference between the other groups (group 1 and 3, p = 0.091; group 2 and 3 p = 0.144) was observed.

Table 3. Summary of quantitative ratings by group (1-5 scale)

Rating item	Group 1 (Basic)	Group 2 (Intermediate)	Group 3 (Advanced)	Statistical test results
Excitement about the H-Cube	M = 2.65 (SD = 0.96)	M = 3.35 (SD = 1.20)	M = 3.10 (SD = 1.04)	F(62) = 2.16, p = 0.125
Excitement about own application	M = 2.65 (SD = 1.01)	M = 3.17 (SD = 1.05)	M = 3.25 (SD = 1.22)	F(62) = 1.72, p = 0.188
Perceived future brightness of the H-Cube	M = 3.15 (SD = 0.85)	M = 4.13 (SD = 0.95)	M = 3.70 (SD = 0.90)	F(62) = 6.01, p = 0.004

DISCUSSION AND CONCLUSIONS

Theoretical Interpretation of Findings

This experiment suggests that linguistic sophistication influences creative ideation in ways consistent with established cognitive mechanisms. Participants exposed to simplified explanations tended to produce benefit-focused interpretations and abstract applications, whereas participants given technical explanations emphasized physical mechanisms and generated domain-specific ideas. Although Group 2 showed higher perceived future potential ratings (M = 4.13 vs. 3.15 for Group 1), this difference should be interpreted cautiously; it suggests a potential optimal balance between accessibility and depth rather than a definitive effect.

The findings align with Construal Level Theory. Simplified, metaphorical descriptions increased psychological distance from the technology, inducing high-level construal that supported broad, exploratory thinking. For example, descriptions such as “little trampolines” encouraged participants to consider abstract use cases rather than mechanism-driven ones. In contrast, technical language reduced psychological distance, inducing low-level construal. This shift is reflected in a suggestive trend in the mechanism-focused responses: 42.5% of participants in the advanced condition emphasized physical mechanisms compared with 17.5% in the basic condition. While the chi-squared test did not reach traditional significance thresholds (p = 0.097), the medium effect size (Cramér’s V = 0.21) indicates practical differences that merit further investigation.

Staged Ideation Model and Practical Applications

Taken together, these results support a staged ideation model in which varying language sophistication serves as a tool for guiding cognitive transitions across phases of innovation. Stage 1 uses abstract language to reduce fixation and promote divergent idea generation. Stage 2 uses moderately sophisticated language to balance creativity with emerging feasibility considerations, consistent with the promising trend observed in Group 2. Stage 3 introduces technical language to enable low-level construal, fostering detailed feasibility assessment and the application of domain expertise.

This model parallels existing innovation methodologies such as Design Thinking and Stage-Gate processes, which move from broad ideation to focused refinement. Its novel contribution lies in demonstrating that language sophistication itself can function as a practical, low-cost intervention to scaffold these cognitive shifts.

For interdisciplinary innovation teams, particularly in research environments like CERN IdeaSquare, these findings suggest that communication challenges may be addressed through strategic language choices rather than simply avoiding jargon. Technical language serves functional purposes in convergent phases, while simplified language facilitates inclusive divergent exploration across disciplines. In technology transfer contexts, different construal levels can serve different stakeholder interactions, with abstract language for exploring market possibilities and technical detail for addressing implementation feasibility.

Limitations and Future Directions

Several limitations qualify these findings. The sample was heavily weighted toward participants with technical backgrounds (76.2%), limiting generalizability to broader populations. Focusing on a single technology also constrains domain transferability, and the controlled experimental environment may not reflect the complex dynamics of real-world innovation settings. The observed differences in mechanism-focused responses, while practically meaningful, reflect *suggestive trends* rather than statistically conclusive effects.

Future research should validate the staged ideation model in applied innovation environments, particularly through comparative testing at CERN IdeaSquare. Additional studies should examine whether these effects generalize across technological domains, how individual differences in default construal level influence responsiveness to language manipulation, and how Large Language Models might automate the generation of explanations at controlled sophistication levels to support scalable implementation.

Conclusions

This study provides evidence that language sophistication influences creative ideation by manipulating psychological distance and associated construal levels. Different linguistic framings bias thinking toward either divergent exploration or convergent refinement. The proposed staged ideation model integrates these insights into a coherent framework that can be readily applied in interdisciplinary innovation teams.

Rather than treating simplified and technical language as competing modes of communication, the model positions them as complementary cognitive tools suited to different innovation phases. By strategically modulating explanation sophistication, teams can promote both creative breadth and technical rigor, ultimately improving the generation and evaluation of innovative solutions. As innovation increasingly relies on diverse, interdisciplinary collaboration, such deliberate linguistic interventions offer a practical means of supporting both openness and precision within the creative process.

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SUPPLEMENTARY MATERIALS

The survey has been provided in SUPP 1. The audio scripts for the technology explanation audios have been provided in SUPP 2. The rubric used for analysing the quality of the survey responses has been given in SUPP 3. In addition, the audio itself (1-3), survey responses (4-6), and the annotated survey responses (7) have been provided separately for the sake of completion and reproducibility in extended data 1-7.

CONFLICTS OF INTEREST

None to declare.

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SUPPLEMENTARY MATERIALS

SUPP 1: Survey

This survey aims to aid our research into how the mode of presentation and the ideation process correlate. To this end, this survey contains a recording about a technology developed at CERN, H-Cube. Following this recording is a series of questions, often found during the ideation process.

Question 1:

What is you are of expertise?

- Computer science
- Aerospace engineering
- Economics
- Humanities
- Applied mathematics
- Applied physics
- Biology
- Electrical engineering
- Communication studies
- Law
- Architecture
- Business administration
- Other: ____

Question 2: What is the first thing that comes to your mind when reading the following?

With H-Cube, we know how to cheaply and portably capture light that is not visible to the human eye.

____

The following (short) audio presents the technology. Please listen to it **once** and answer the following questions.

Question 3: What are the key points of the technology?

____

Question 4: What possible uses of H-Cube come to mind?

Please assume that the only restriction of uses is given by the laws of physics. Be as creative as you wish during this brainstorming and disregard any feasibility concerns.

____

Question 5: Are you excited about the H-Cube?

1. I am not excited at all

|

5. I am very excited

Question 6: Are you excited about the possible applications that you have found?

1. I am not excited at all

|

5. I am very excited

Question 7: Do you think the future of H-Cube is bright?

1. I do not see any potential

|

5. I think H-Cube has the potential for global applications

If you would like to share anything else with us, we are happy to hear from you.

Question 8 (optional): Other remarks / ideas?

____

SUPP 2: Audio scripts

Script 1: Basic Level (Simple and Accessible Language)

"Imagine a camera that can see a special type of light that we can't see with the naked eye. These waves are called terahertz waves and they are completely harmless – unlike X-ray. The camera sees this light by having little trampolines that shake when hit with this special light. Terahertz can pass through materials like plastics and cardboard but is absorbed by things like water and reflected by most metals. To top it all off, this camera is cheap and portable and can operate at room temperature."

Script 2: Intermediate Level (Moderate Complexity)

"This innovative camera technology uses terahertz waves, a type of light that is invisible to the human eye. The camera contains a sensor made of tiny mechanical parts that vibrate when terahertz waves hit them. As these waves cause the parts to heat up, their vibration changes, and the camera captures images of objects that other cameras can't see. Unlike older technology that needed extremely cold conditions, this system operates at room temperature and is more affordable. Terahertz waves are also safer than X-rays and can identify materials like water, metal, and plastics thanks to the unique way they interact with certain substances."

Script 3: Advanced Level (Technical and Detailed)

"This advanced imaging technology leverages the unique properties of terahertz (THz) radiation, situated between microwave and infrared frequencies on the electromagnetic spectrum. The sensor array, comprising a 360x240 grid of micromechanical resonators, is engineered to detect subtle shifts in resonance frequency induced by the thermal expansion of these resonators upon absorption of THz waves. This expansion modulates the internal stress of the resonators, providing high-sensitivity detection capabilities. H-cube technology addresses the long-standing challenges associated with THz wave generation and detection by obviating the need for cryogenic cooling and drastically reducing costs. Additionally, the terahertz spectrum's ability to detect polar molecules, and its limitation in penetrating thick water or metal layers, allows for precise material characterization via spectral 'fingerprints' in this range."

SUPP 3: Rubric for grading the key point responses

Response type	No understanding of the technology	Emphasis on the physical workings behind H-Cube	emphasis on the advantages relative to similar technologies	combination of both the mechanism and advantages of the H-Cube
Description	An answer where it is clear that the participant does not understand the technology at all.	An answer where it is clear that the participant considers the key point of the technology to be the physical mechanism behind the technology.	An answer where it is clear the that participant considers the functionality or advantages of the technology to be the key aspects of the technology.	An answer where the participant considers the mechanism behind the technology and the functionality of the technology in a balanced way.
Example answers	"Captures terrords" "A camera that can capture temperature and gamma rays, and something about the light bouncing off like a trampoline? Terror head? What's that?" "Invisible light	"Trampolines in the camera that shake with the special light. " "A technology that is able to detect THz light radiation to detect light beyond the visible spectrum. This radiation heats up the sensor upon impact allowing for an image to be detected."	"Affordable, portable, harmless, invisible to the naked eye " "It's possibly cheaper and has a differentiated set of uses which seem to be superior to what is known"	"The camera uses a type of light invisible to the human eye. Camera catches things thanks to the reverberation of the waves. It operates at room temperature and is more affordable. The waves can identify thinks like water, metal and plastics."