UNIVERSITY OF PADOVA

Department of General Psychology

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Final Dissertation

LAB TO TABLE SCIENCE:
A Preliminary Study on
Promoting Effective Dissemination of Research Findings

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ABSTRACT

In this research project, instructional multimedia tools that assist scientific findings from laboratories to arrive directly at an audience's "table" are investigated. The research aims at providing new approaches to improve scientific dissemination using instructional multimedia and online communication platforms. Current studies hold importance due to rapid changes in communication technology and the deterioration of accessible truthful information. Seven principles that are essential for instructional design in multimedia are introduced. In consideration of these principles, two different instructional videos were prepared using a 2016 neurobiology research paper on learning and memory in newborn domestic chickens. One video was prepared in the light of these principles while the other version was adjusted in a contradicting manner. To inspect the difference in the quality of the two videos and learning outcomes, an online survey was prepared and administered to 125 participants. Results revealed that participants enjoyed their learning experience more when they were watching the well-designed version of the video. However, the analysis also revealed the limitations of secondary language learning and cognitive load. Overall, viewer satisfaction and comprehension were found to be greater when instructional multimedia was administered in agreement with the cognitive capacity and preferences of the human brain.

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INTRODUCTION

"Learning never exhausts the mind."

- Leonardo Da Vinci (1452 - 1519)

While from a philosophical point of view this quote can have significant meanings, from a psychological point of view, yes, the mind gets exhausted. Especially now, by having easy access to fast-speed, sensory-laden social media platforms, we may have allowed our minds to get lazier (Firth, 2020). The development of entertainment and communication technologies has facilitated individuals in their excessive use of online platforms. There is some evidence which suggests that individuals who multitask heavily with technology tend to *self-report* more attention difficulties, distractibility, and impulsivity (Vedechkina et al., 2021).

According to DataReportal statistics in 2021, daily internet usage included 62.5% of the world population, while 58.4% actively used social media (Kepios, 2022). These percentages show that more than half of the world is online, scrolling through social media every day. On social media, in order to make the news more appealing and interesting to the viewer, the credibility and accountability of the information almost diminishes, creating a cluster of misleading "facts" circulating on the internet. Research findings report that the trustworthiness of social media platforms as a source of information differs across the globe, people still use some of these platforms (i.e. Facebook) as their primary source of news (Karlsen et. al., 2021). In this epidemic of information, fake news poses a great danger. Fake news is specifically designed to plant a seed of mistrust and exacerbate the existing social and cultural dynamics by misusing political, regional, and religious undercurrents (Talwar et. al., 2020). During the 2016 USA presidential elections, it was estimated that over 10 million tweets were related to fake news, causing Macquire dictionary to select "fake news" as the word of the year (Hunt, 2017).

Nevertheless, the internet not only provides a medium for publishing fake news but also offers tools to actively promote dissemination. For the promotion of trustworthy information, the source of the information plays a substantial role. Most of the time, reliable and truthful knowledge is acquired through scientific analysis and research. Furthermore, these findings are regularly distributed in credible, globally accepted scientific journals after rigorous revisions from other scientists who are experts in the same field. Thus, it can be accepted that the information provided in these scientific articles is more verifiable if they are provided by credible sources such as

Cell, Science, Nature, and so on. In this paper, new ways to disseminate scientific findings besides scientific publications are investigated.

Using the opportunities provided by the growth in communication technologies, a methodology to create an instructional video of research findings that the scientific community could embrace in order to disseminate recent discoveries to a mass audience is introduced. The present study uses seven principles from cognitive science that should be considered when preparing an instructional multimedia video and the rationale behind these principles. Finally, whether this suggested method can be favorable and comprehensible enough to communicate the results of research findings is further investigated. For the study, the 2016 research article from the University of Padova by Rosa Rugani, Giorgo Vallortigara, and Lucia Regolin titled *"Mapping number to space in the two hemispheres of the avian brain"* was chosen (Rugani et al., 2016). For comparative reasons, two versions of a video were prepared, using the same footage while changing the editing techniques of these videos to determine whether the suggested methods aids learning through multimedia more than an arbitrarily prepared video. Furthermore, viewer satisfaction and preferences for learning methods in a population of 125 people are observed.

- SECTION 1: Motives Behind the Study

1.1 The Value of Art in Science & Communication

> *"To develop a complete mind: Study the science of art; Study the art of science. Learn how to see. Realize that everything connects to everything else."*

These are once again, words from the Italian painter, engineer, scientist, theorist, sculptor, and architect Leonardo Da Vinci. During the Renaissance era, artists of the time highlighted *reason* and *scientific examination* in their study of nature. Da Vinci personally focused on the human body and its capabilities just for the sake of *visualization of knowledge,* the Greek philosophy that heavily influenced him. To better visualize knowledge, he examined nature and observed the human body, measuring the proportions of any male model he could find in Milan. His interest in observation and artistic skills led him to demonstrate many things that nobody else at the time could; for example, Leonardo was the first to discover the four-chamber heart, as we know it today (Roberts et al., 2019). At the time, illustrations were considered trivial and thought to be compromise the mastery of anatomical texts. However, he stated:

"One should not encumber oneself with words unless speaking to the blind. As functional anatomic illustration effectively gives synoptic knowledge impossible to convey without multiple tedious dissection cases or, perhaps verbosity of text."

Throughout history, it is possible to see that those important historical events, religious messages, and key occurrences were communicated to the public through paintings and visualizations of events such as theatrical plays or paintings (see Raphael, *School of Athens*, 1551). Since the general population did not know how to read and write, it was crucial for the Church to demonstrate what they want to convey in visual forms so that society would be influenced by it and diffuse the information even further.

In fact, there are cave paintings, (considered the oldest form of communication) that date back to 13,000 BP[1], and the introduction of Greek letters (allowing. the invention of literacy) were around 700 BCE[2]. On the other hand, words and pictures are both collections of symbolic images; words are signs composed of lines, curves, and open and closed shapes; words, as with pictures can be presented in a variety of colors, forms, depths, and movements (Lester, 2015). As Aristotle (384-322 BCE) says; *"There can be no words without images"*. The history of distribution of information through artistic formats rather than text cannot be ignored and this method should still be encouraged. Therefore, in order to promote the retention of truthful information that is intended to provide knowledge to mass audiances, visual instructional features (such as videos, descriptive images, and visual cues) should be promoted. Further investigation is needed to develop a formal method of distribution, further investigation is needed which will be provided in this article in "Section 2: Theoretical and Conceptual Framework of the Study".

1.2 The Importance of Direct Communication Between Science and Society

Science communication is a multi-branched topic that is constantly undergoing profound change. As interest in reading paper journals is declining rapidly, subscription rates to such journals are also low due to overpriced subscription fees. Whilst having online resources for distribution will ease this problem, it will also help build a bigger communication circle if the sources are

[1] B.P. indicates for "Before Present" which is the time scale used in archeology, to specify when events occurred relative to the origin of practical radiocarbon dating in 1950s. To detect the dates aforementioned, nine bison drawings were found in three caves in the Cantabrian region of Spain (see Valladas, H., 2001).

[2] The introduction of the Greek letters into inscription around 700 BCE altered the character of human culture, creating a gulf between all alphabetic societies and their precursors (see Heyer et. al., 2019).

used correctly. By ‘using the sources correctly’, it is meant that the distribution of information should both fit viewers' capabilities and preferences. The capabilities and preferences of the human mind will be further discussed in Section 2.

However, recent explosion of electronic communication platforms has led to the mass publication of unreliable, not reviewed, and deceitful articles that identify as scientific papers. In order to tackle the pandemic of fake information, well-grounded sources, (i.e., scientific journals that provide a process to review the reliability of the publication), need to submit to this never-ending change and embrace new mediums of communication. According to DataReportal, in July 2022 there were 4.70 billion social media users around the world which is equivalent to 59% of the world population. With 2.797 billion monthly active users Facebook stands at the top of the most preferred social network platforms, followed by YouTube and WhatsApp. The presence of critical scientific journals on these platforms is influential since it is less demanding to connect with the community on a bigger scale.

Since many lifestyles and food brands manage to achieve high levels of user engagement, there may be lessons to be learned from the methods they use to promote their materials across various social network sites. Research on the role of social media content on users’ engagement behavior concluded that posts in video format encourage users to actively engage on page by sharing their opinion and comments toward advertising company’s posts, while photo formatted content stimulates passive user engagement through liking behavior (Shahbaznezhad et al., 2021). Such formats of communication also hold great value for scientific community. Considering these methods (video and image formats) can be replicated, it is a matter of asking how these methods can be utilized in a manner that will both provoke interest and also provide true information, thus, learning. This question is tackled with the principles that are provided within Section 2. Though most will agree that it is important for scientists to be able to communicate to non-scientists, this is a difficult skill that many practicing scientists lack, likely due to the combination of increased specialization over time and the absence of formal training in science communication (Brownell et al., 2013). For science communication to play its mediating role effectively, an evidence-based approach is proposed, by which the scientific information can be disseminated within the preferred networks of the lay audience. In a future where every aspect of daily life becoming digitalized, science communication also needs to find a space where it can help the growth of the knowledge of layperson. Ultimately, the herd mentality phenomenon is widely seen within social media platforms, providing many examples on how people can be influenced by others to adopt certain attitudes (Lee, 2016). This phenomenon should be used in favor of the science community, instead of belief in fake news and adaption of wrong information, the news should be communicated in a way that attracts attention from the population and allows putting trust in the information.

1.3 Rigorous Growth of Fake News & Attention

Nowadays, as a result of the rapid growth in communication technologies, from the moment we wake up, we are exposed to various social media platforms, easily, through one click. Accompanied by this easy access, we are constantly receiving various information delivered in short, easy-to-understand methods. In 2016, Darla Rothman, stated that "Continued interactions with a fast-paced, sensory-laden, multimedia environment predispose/influence a brain to a shorter attention span". Evidence for this comes from "collective attention-span studies" in reference to the amount of attention a popular topic receives on a population level (Lorenz-Spreen, 2019). The study found strong evidence that in the course of time, after the first publishing, the topic, while popular, receives diminishing attention on a population level. This suggests that the abundance of information available today is indeed shortening the attention spans of the population (Firth, 2020).

Besides, as a part of the Cognitive Load Theory of Chandler and Sweller, it is accepted that the channels of the human information processing systems have a limited capacity to process information at one given time period. Therefore, that meaningful learning requires that the learner engages in substantial cognitive processing during learning, but the learner's capacity for cognitive processing is severely limited (Mayer, 2020). The limits of cognitive load and the attention span provide us a basis to understand why people take the easy road and, without further investigation accept fake news as facts.

While it is widely agreed that the internet can serve as a tool for enhancing well-being (through socialization possibilities or educational opportunities), signs of the negative impact are also easily detected. *"Fake news"* that is easily accessible online, poses a great danger. *Fake News* is the news that does mischief with the truth (Jaster, 2018). That is because, fake news is characterized by two shortcomings: *(1)* it is either false or misleading *(lack of truth)*, *(2)* and it is propagated with either the intention to deceive or an utter disregard for the truth *(lack of truthfulness)*

(Jaster, 2018). Fake news, in general, lacks the processes that ensure the accuracy and credibility of information. Fake news is also a clear representation of the phenomena called misinformation (misleading information) and disinformation (false information that is purposely spread to deceive people). The automation of information distribution in the 21st century allowed easy dissemination of any information through social media platforms. In order to communicate scientific findings with internet users from their preferred methods of interaction (through social media platforms) and tackle the pandemic of fake news, the method of *multimedia learning* can be preferred. Multimedia learning can be beneficial in the dissemination of scientific research findings due to its similar nature to social media content (short videos with background music and text, e.g. TikTok videos).

- SECTION 2: Theoretical and Conceptual Framework of the Study

2.1 Multimedia Learning

In 2003, psychology professor Richard E. Mayer from University of California defined multimedia learning as:

> *"Learning from words and pictures, and we define multimedia instruction as presenting words and pictures that are intended to foster learning. The words can be printed (e.g., on-screen text) or spoken (e.g., narration). The pictures can be static (e.g., illustrations, graphs, charts, photos, or maps) or dynamic (e.g., animation, video, or interactive illustrations)."* (Mayer, 2003)

The term "multimedia" can hold different meanings in different contexts. In a technology context, it is using multiple delivery styles such as speakers, screens and computers. As a presentation format, multimedia means use of different forms of representation like pictures and texts. From the sensory modalities perspective, this translates as the use of multiple sensory organs such as ears and eyes. From the psychological point of view, the essence of multimedia learning is the combined comprehension of texts and pictures. In fact, comprehension is highly dependent on the kind of information is presented and how it is presented (Schnotz, 2014). Multimedia learning occurs when an individual understands the displayed information, that is, when the individual uses external representations in order to construct internal (mental) representations of the learning content in working memory and if he or she restores these representations in long-term memory (Schnotz, 2014).

In today's world, in order to foster meaningful learning, one should not only be able to use multimedia learning tools but also be present on various platforms that assists communication. Given that an increasing amount of our lives is spent interacting through social media platforms, more people tend to search for and consume daily news from social media rather than traditional news organizations (She, 2017). The reasons for this change in consumption behaviors are inherent to the nature of these social media platforms: (1) it is often more timely and less expensive to consume news on social media compared with traditional news media, such as newspapers or television; and (2) it is easier to further share, comment on, and discuss the news with friends or other readers on social media (Shu et. al., 2017). In order to incorporate multimedia learning on social media platforms, multimedia learning tools need to be further explained. A simple example for multimedia instruction can be a narrated animation, explaining in a straightforward manner how a system works, like how a plant grows, how a plane takes off. Moreover, *meaningful learning* is defined as deep understanding of the material, which includes attending to important aspects of the presented material, mentally organizing it into a coherent cognitive structure, and integrating it with relevant existing knowledge (Mayer, 2003). Thus, the ability to reflect and apply what was thought is the main outcome expected from meaningful learning. Overall, this research project's strategy has been founded on the notion that the best way to enhance instructional multimedia learning is to start with an understanding of how people learn, based on research. To foster meaningful learning, constraints, and the capacity of the human brain; the quality, and the clarity of the information; and limits of attention needs to be handled properly. In both videos produced by the research team, in order to effectively use multimedia instruction methods, explanation of rotation of the jars by 90 degrees were provided with a stop-motion animation instead of a static image. In addition to that, in video format A, instructions are reinforced with illustrations where it was necessary. Four principles of cognitive psychology which were considered to benefit from the advantages of multimedia learning are investigated in subchapters 2.4 through 2.7.

2.2 Media Richness Theory

Media Richness Theory is a well-known theory of media use introduced by Richard Daft and Robert Hengel in 1986. Since then, it has been applied to various fields. The theory is based on the objective characteristics of media channels abilities to reproduce the information that has been sent over it. Hengel and Daft illustrate *"information richness"* as the ability of information to change understanding in a time interval. The theory also suggest that each communication media differs in its ability to enable users to communicate and change understanding. The level of this skill is described as the mediums' *"richness"*. Theory consists of four dimensions: (1) the ability to simultaneously handle multiple information cues, (2) the ability to facilitate feedback, (3) the ability to establish a focus for the individual, (4) ability to utilize symbols or alternatives in order to convey information. The underlying message of this theory is that communication efficiency can be improved by matching media to users' information needs (Daft & Hengel, 1986). The term "rich media" in this context provides an umbrella expression to describe online content that has multimedia elements such as sounds, video, or content that moves when a user clicks on the page that features the content (Shahbaznezhad et. al., 2021). For research purposes, above-mentioned dimensions of the media richness theory were considered during the preparation procedure. While keeping in mind the memory load several informational cues were integrated in video format A to present the information in a manner that satisfies the needs of information processing of the mind. To facilitate feedback, the notion of cause-and-effect was handled carefully and in both video formats, the provided text was written in a manner that provides the reasons of events. Furthermore,, in video format A, the provided text was integrated within the video to match each occurrence of events and used the visuals in the video to yield an answer to the text that precedes it. Moreover, images derived from a science article (see Walls, 2022) that depicts the hemispheric specialization of visual processing were integrated into Video Format A to further convey the information. Finally, to establish focus for individuals and to avoid overflowing cognitive load, auditory channels were used to induce attention, based on previous research (see subchapter 2.7), Mozart's sonata K448 was chosen.

2.3 Cognitive Load Theory

Cognitive load theory as presented by Sweller (2011) uses evolutionary theory to consider human cognitive architecture and uses that architecture to devise novel, instructional procedures. The theory suggests that knowledge can be divided into two subcategories: (1) biologically primary knowledge that we have evolved to acquire; (2) biologically secondary knowledge that is subject to instruction but important for cultural reasons (Sweller, 2011). When dealing with secondary knowledge, human cognition entails a massive information store, the contents of which are largely derived from other information stores. Therefore, cognitive load refers to any demands on working memory storage and processing of information. Instructional multimedia learning can be considered as secondary knowledge that requires greater information store and processing. Based on three assumptions of how the mind works in multimedia learning, introduced by Mayer and Moreno (2003), approaches to reduce cognitive overload can be reasoned. The first assumption is the *dual channel assumption*, suggesting that humans possess separate information processing channels for verbal and visual material. The second is the *limited capacity assumption*, which means there is only a limited amount of processing capacity available in the verbal and visual channels. Finally, the third assumption is *active processing*; proposing that learning requires substantial cognitive processing in the verbal and visual channels. As a result, cognitive overload occurs when these three assumptions are not respected and the quality of learning experience fails to reach its potential. Alongside this information, in preparation of Video Format A, cognitive overload can be reduced by several editing tricks. The instructional video can be designed to create segments between important information, so that the brain can have enough time for information processing, and the capacity of processing can be controlled by eliminating auditory sensory system for communication of information and using the auditory system to induce attention instead. More ways used to tackle cognitive overload will be further explained in the forthcoming subchapters (subchapters 2.4 through 2.7). Evidently, the cognitive load theory and its implications hold an important place in multimedia learning. The richness of the content needs to be carefully designed to encourage learning while allowing the brain to easily process arriving information. By carefully selected methods, close attention is paid to cognitive capacities while editing the video footage for format A. In order to compare the difference, none of the selected principles are used in video format B.

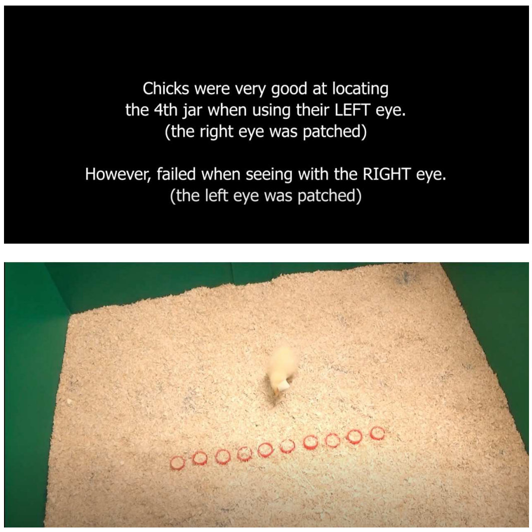
2.4 Split-Attention Principle

As previous chapters demonstrate, multimedia learning can be very complex and involve a variety of representations for the learning content. It can include text, graphics, maps, sounds, and videos which individually has different processing paths within the brain. Split-Attention Principle proposes that when designing instructional multimedia, it is crucial to avoid formats that would require the learner to split their attention and mentally combine the different sources of information. Research on effects of combining text and pictures presents promising results

(Clark and Paivio, 1991). Empirical evidence suggests that students usually learn more effectively when they're presented with both words and pictures rather than words alone. This is what Richard Mayer (1997) called *"the multimedia effect"*. On the other hand, John Sweller (2011) proposes that materials of instruction should be formatted so that disparate sources of information are physically and temporally integrated, thus anticipating the need for learners to engage mental integration. The example for this principle is provided in video format A; within the video, related imagery is given at the same time as the necessary information is provided. This is done to not to split the attention into separate image and text comprehension. On the other side, video format B is purposely prepared so that the attention will be split into specific formats and the learner will read the text first and then watch the related information afterwards (see Images 2.1 and 2.2*)*. If the words and pictures are semantically coherent, meaning that they are related to each other and they are presented close together in space and time, in a sense if they are contiguous, learning is improved. If a picture is combined with written text, all information must enter working memory through visual register (Schnotz, 2014). Spatial contiguity is a way to minimize the loss of information due to split attention and to allow an approximately simultaneous availability of pictorial and verbal information in working memory (Schnotz, 2014). This principle also has some constraints about prior knowledge and language. If the presented instructions are not understood by the learner, holes in understanding are expected to be filled with prior knowledge on the subject while creating the mental representations. Besides, it is important that the given instructions are in the language range of the learner, hence, using sophisticated science language throughout the instructions will only complicate the learning process.

Image 2.1 *Video format A: designed to control split-attention principle and media richness.*

Image 2.2 *Video Format B: description is given in a simple format before the footage.*



2.5 Redundancy Principle

Redundancy effect implies that excess material on the screen interferes learning rather than facilitating it. *Redundancy* occurs when the same information is presented concurrently in multiple forms or is unnecessarily elaborated (Mayer, 2014). For example, providing text in both auditory and visual modalities inhibit learning by increasing the cognitive load of processing information, generating heavy demand on working memory. When spoken explanations are used concurrently with the same written text, learners are likely to attempt to relate and coordinate the corresponding elements of written and spoken information (Mayer, 2014,). This way of processing is extraneous to learning and unnecessarily take up space in working memory.

For this reason, no additional superfluous information was included to any of the formats. In the current experiment, all necessary information was given in text form, leaving auditory channels for inducing attention. At the same time, based on the same logic, from the designated article (see Rugani et. al., 2016), any information that is crucial for the experiment but not essential for the understanding of the research implications was excluded in collaboration with the authors of the article Ph.D. Rosa Rugani and Prof. Lucia Regolin (e.g. randomization procedures to a full extent). This theory is supported by an experiment of Reder and Anderson (1982), where results indicated that subjects learn information better when they read a summarized version of the original text than when they read the original chapter.

One negative effect of the redundancy principle is seen during second language learning. In the case of learning through a secondary language, referential connections are built simultaneously while the information is being processed. Also, as mentioned in subchapter 2.4, not having enough resources available to refer the information could also interfere with the task. This procedure creates overload in the working memory, causing the redundancy effect by itself. Thus, redundancy principle suggests that when dealing with second language learning, involving both written and spoken text simultaneously is not efficient as an instructional procedure.

2.6 Signaling (Cueing) Principle

The signaling principle, also known as the cueing principle, refers to the finding that people learn more deeply from a multimedia message when cues are added that guide attention to the relevant elements of the material or highlight the organization of the essential material (Mayer, 2014, pg. 263). Since processing the most relevant information (such as implications of the study) is crucial to learning, it is advantageous to guide learners' attention to the essential material. Thus, for the signaling principle it is particularly important to select the right information. Cues can come in many forms in multimedia learning. It can be incorporated into text, a picture or both. For example in Image 2.3, three forms of signaling can be detected. First, the cue is provided within text by creating a time interval between the essential material, an interrogative question and the answer to the question. By this, it is expected that the learner receives the crucial information, sees the question and tries to provide answer by themselves while getting confirmed that the answer will be provided in an upcoming sequence. This notion can also strengthen second dimension of media richness theory: *the ability facilitate feedback*. A second form of signaling in Image 2.3 can be seen in the first box. In Video Format A, before the newborn chicken does the intended action that is suggested by the text, a circle and a cross appear on screen, drawing attention to what the chicken will do next. The third and final example of cueing of information that is used in Video Format A is detectable on box 5 of Image 2.3. In the mentioned box, an image is added to support the implication of the study aimed to accelerate the acquisition of knowledge. At the same time, the right hemispheric pathway is highlighted on the image to reinforce the essential part of the imagery. Throughout Video Format A, many forms of cueing principle were utilized since it is one of the strongest tools of multimedia learning. Image 2.4 and Image 2.5 can accommodate further understanding.

Image 2.3 *Sequences from video format A, Box 1 (left upper corner) to 6 (right lower corner).*

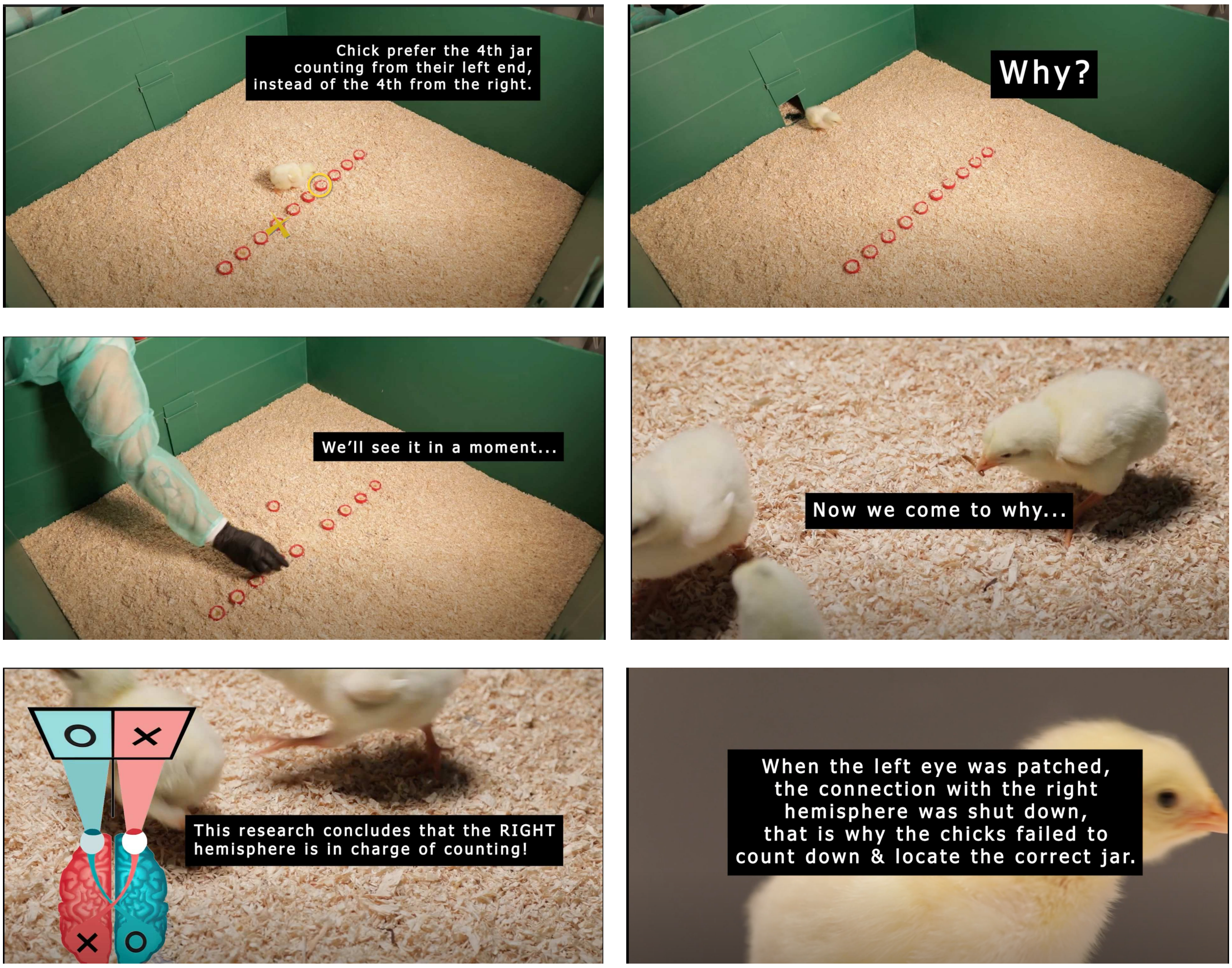


Image 2.4 *The information on the text is re-inforced by highlighting the eye-patch of the newborn chicken as it is moving.*

Image 2.5 *The eye that is patched is signaled through the imagery while a cue is given to show the jar that the chicken will go next.*

2.7 Music as a Background Sound and The Mozart Effect

Long-standing influence of sounds on the human brain, therefore it's influence on the daily experience cannot be dismissed. As a primary stimulus source, music is used to provide entertainment, aesthetic or spiritual experiences, and a secondary stimulus source, music is used in the background (de la Mora Velasco et al., 2020). In movies, the structural elements of the sounds, evoke emotions and help people associate with the information that is presented. On the other hand, one other purpose of music is to improve attention. In a review article on Effects of Background Music, where they collected thirty studies that compare different genres of music, it was suggested that college students used music while studying to increase their concentration, as well as presenting results that instrumental background music positively affects the attention in workplace (de la Mora Velasco et al., 2020). In the same article, investigation of the literature revealed that, even though across studies the overall effects of the background music are inconclusive, some genres of music provide better results than others. For example, genres of rock or pop shows negative effects across various studies (see de la Mora Velasco et al., 2020) whereas, classical music has positive effects on the subcategories of these articles (such as attention, cognition, learning etc.). When classical music genre is further investigated, a phenomenon called "The Mozart Effect" is highlighted in various papers. The Mozart effect shows a possible yet contradictory effect on performing cognitive tasks. It is based on the idea that listening to classical music enhances intelligence. In several papers, Mozart's K448 is used as the chosen composition, with contradicting results. One study on the Mozart Effect concluded that it elicited more persistent media attention than other science reports (Bangerter et. al., 2004). Given that the Mozart effect has attracted a lot of attention as a scientific legend in the lay culture, it was considered well-suited for this research, and was included in the video format A as a background music. To create a contradicting format, (suggesting negatively affecting attention), for video format B, background music from pop/rock genre was chosen and purchased with a license from audiio.com.

- SECTION 3: Research Design

3.1 Research Question and Hypothesis

The broad aim of this research is to utilize established principles and methods of science to improve and support dissemination of scientific knowledge. In this paper, it is attempted to establish an effective method of distribution of scientific information through multimedia tools. The study focuses on capabilities of human cognition, media richness and learning through multimedia. In order to determine the effective ways and what manipulations can be done to achieve active learning, the designated research article (see Rugani et al., 2016) is provided in two video formats (Video Format A, and Video Format B). Concerning the research question at hand: “Are there established methods to improve and support scientific dissemination?”, seven themes were investigated and integrated in the preparation of the two videos. expected outcomes for the research is as follows;

H1: High media richness (video format A) positively stimulates learning.

H2a: Classical music as a background sound (video format A) positively stimulates attention.

H2b: Pop/Rock music as a background sound (video format B) negatively affects attention.

H3: Consideration for split-attention format (video format A) positively stimulates learning.

H4: Consideration for signaling principle (video format A) positively effects learning.

H5: Including redundancy principle affects overall learning.

3.2 Methodology

For data collection, an online questionnaire was created using Qualtrics software. It was chosen for research purposes since it allows online data collection and cloud storage, question customization and randomization, and easy data exportation. When used correctly, a video instruction was proven to be an effective method for learning, thus two videos were designed by the research team. The footage used in this study refer to various experiments carried out at the University of Padova Psychology department animal cognition laboratories between September 2021 and August 2022. Most of the footage was captured in collaboration with Ph.D Salvatore Frisina, specialized in anthropology of storytelling while the videos that demonstrates the result and the success of newborn chickens were derived from the database of animal cognition laboratories. Once all the necessary footage was collected, the professional editing software DaVinci Resolve

18 was used to edit the footage free of charge, creating two informational videos, designed to convey the information in different ways to test the hypotheses of the study. Once the editing was over, videos were uploaded on YouTube with a restricted access, allowed only to people with the link. YouTube was chosen because of the easy collaboration with Qualtrics. By this method, videos were embedded into the questionnaire.

Video A or B was randomly assigned to the participant via Qualtrics software and each participant answered the same questionnaire in order to detect comprehension, attention and viewer satisfaction. The questionnaire was prepared by the experimenter in consideration of interdisciplinary study of*"How Question Type Influences the Linguistic Complexity of Primary School Students' Responses"*(see Blything et. al., 2019). It included nine multiple choice questions about comprehension and attention, five questions in order to detect viewer satisfaction as well as five questions investigating the background of the participant. The list of questions can be found in Table 3.1.

Video A was methodically designed considering the media richness theory, the memory load principle, split-attention principle, modality principle, the Mozart effect and, cueing of information; Video B was simply the same footage provided with an explanation part at the beginning of the video with black background and white text. Description for both videos were kept exactly the same. Images 3.1 and 3.2 provide a better understanding for video A and B.

Image 3.1 *Video A: The explanation of the experiment is provided throughout the video footage along with other cues.*

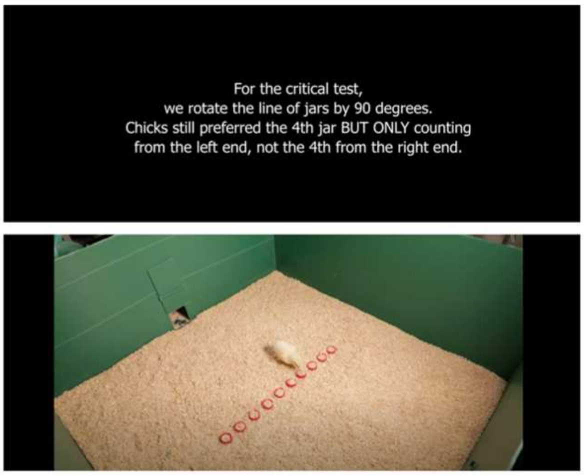


Image 3.2 *Video B: The explanation of the experiment is provided as a plain text before the video footage.*

Table 3.1 *Questions included in the online Qualtrics survey*

Comprehension & Attention (Multiple Choice)	**Viewer Satisfaction**	**Background Information**
CQ1. Which video did you just watch?	SQ1. From 1 to 10 how would you rate the quality of the video?	BQ1. How old are you?
CQ2. What did you think you just watch?	SQ2. How easy it was to figure out the outcomes of the research?	BQ2. What is your gender?
CQ3. What was the topic of this video?	SQ3. How easy it was to follow the text in the video?	BQ3. What is the highest degree of education you have complet-ed?
CQ4. What are the implications of this research finding?	SQR. What do you suggest that we should improve? Explain with words.	BQ4.What is your current occu-pation?
CQ5. Choose the answer with correct order of events.	SQ4. Would you like to learn more about scientific publications with this method?	BQ5. In which country do you currently reside?
CQ6. What does the experi-menter control by randomly swapping the jars?		
CQ7. In which condition the baby chick successfully locates the 4th jar from the left?		
CQ8. Which of the following is the reason that the chick selects the 4th jar from the left?		
CQ9. In the image you are see-ing, which jar did the chicken actually select when it was re-leased to the arena?		

The theme of both videos is numerical abilities of newborn domestic chickens and hemispheric differences for number and space mapping, acquired from the 2016 article of Rosa Rugani, Giorgo Vallortigara, and Lucia Regolin. In Video A, description starts along with the footage, first demonstrating the arena that was used in the experiment, then the training procedure using worms in order to accommodate the newborn chick to the arena. After that, it illustrates the randomization of jars to control for informational cues that the chicken can use. Then, three conditions of the task (right and left monocular conditions on the ordinal task, and binocular condition) are shown along with the information and visualizations that are necessary to bring out comprehension. Finally, implications of the research are provided. Everything included in the video to convey information and create media richness is cited at the end of the video. Both videos last approximately 2:30 minutes.

Data collection started on the 5th August 2022, and ended on the 26th August 2022.

RESULTS & DISCUSSION

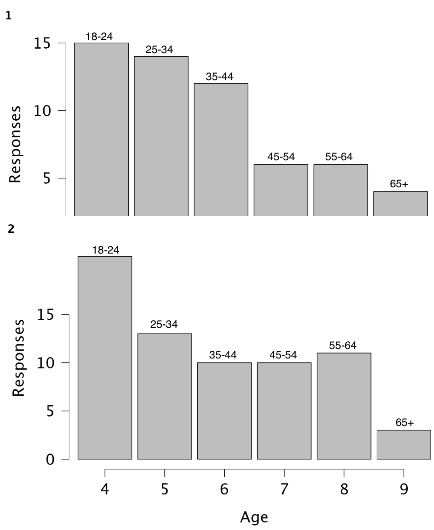
After the data collection, database was exported from Qualtrics in Excel format. For descriptive analysis data was imported into JASP, which is a free and open-source statistical analysis program supported by the University of Amsterdam. Collected data included 125 participants. Out of 125 participants, 57 of them watched Video Format A, and 68 of them watched Video Format B. The distribution of data into Video Format A and Video Format B for genders and age is provided in Figure 4.1 and Figure 4.2. Considering, nationality, the data was separated into native and non-native speakers. Native English-speaking countries were reviewed and out of 125 participants 12 native speakers (from Australia; South Africa; U.K.; U.S.A.) and 113 non-native speakers were detected see Figure 4.3. Three quarters of the non-native speaker participants were of Turkish nationality. The supplementary descriptive data collected can be found in the Appendix.

Figure 4.1 *Frequencies for gender in Video Format A and Video Format B*

Frequencies for gender

VIDEO 1A/2B	gender	Frequency
1 VIDEO A	Male	20
	Female	37
	non-binary / third gender	0
	Missing	0
	Total	57
2 VIDEO B	Male	29
	Female	36
	non-binary / third gender	3
	Missing	0
	Total	68

Figure 4.2 *Frequencies for age in Video Format A and Video Format B*



Frequencies for age

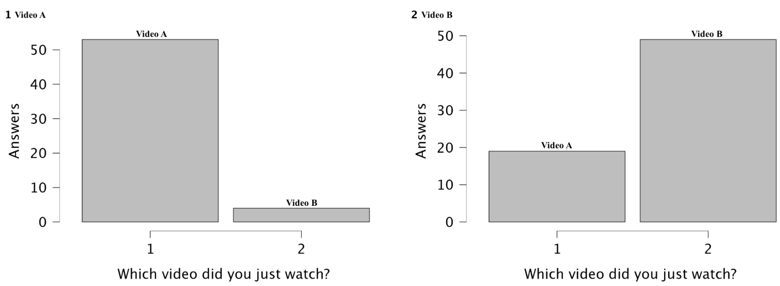
VIDEO 1A/2B	age	Frequency
1 VIDEO A	18-24	15
	25-34	14
	35-44	12
	45-54	6
	55-64	6
	65+	4
	Missing	0
	Total	57
2 VIDEO B	18-24	21
	25-34	13
	35-44	10
	45-54	10
	55-64	11
	65+	3
	Missing	0
	Total	68

	Total	NATIVE	NON-NATIVE
VIDEO A	57	4	53
VIDEO B	68	8	60
Total	125	12	113

Figure 4.3 *Frequencies for native and non-native speakers in Video Format A & Video Format B*

For the analysis, three questions (CQ1;CQ3;CQ5) from Comprehension Questions (CQ) were chosen. The responses yielded interesting results. Responses to CQ1: *"Which video did you just watch?"* demonstrated that participants who watched video Format B(2) were more confused from the beginning, perhaps not paying enough attention to the video. Out of the 68 people who watched Video Format B, 29 participants answered the question wrong meaning that even though the participant watched Video Format B, (s)he selected that they watched Video Format A, also supporting the hypothesis H2b: *Pop/Rock music as a background sound (video format B) negatively affects attention.* Out of 57 participants who watched Video Format A, only 4 of them gave a wrong answer suggesting that classical music induces attention. Figure 4.4 illustrates the results.

Figure 4.4 *CQ1: Which video did you just watch?*



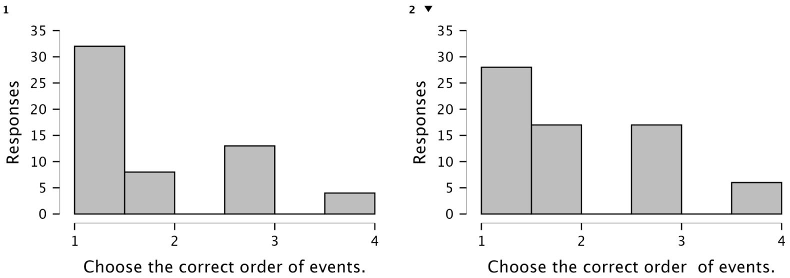
Frequencies for CQ1

VIDEO 1A/2B	CQ1	Frequency
1	1	53
	2	4
	Missing	0
	Total	57
2	1	19
	2	49
	Missing	0
	Total	68

Before revealing contradicting results of CQ3, the question CQ5 *"Choose the answer with correct order of events."* showed that participants who watched Video Format A, which included the informational text presented along with the video footage, was more successful detecting the order of events in the video. In Video Format A, 32 participants out of 57 answered correctly while in Video Format B, the correct answer was given by 28 participants out of 68. This reveals that Split-Attention Principle, does in fact influence learning. In Video Format B, when the informational text was given before the video footage, even though the order of events were given in the exact same structure, it was more laborious for the working memory to connect the two information given in different formats (instructional text and video footage) and different time intervals suggesting that in multimedia learning, high media richness and split-attention principle are positively stimulating comprehension.

The frequency of responses for different answers between two groups can be seen in Figure 4.5.

Figure 4.5 *CQ5: Choose the correct order of events.*



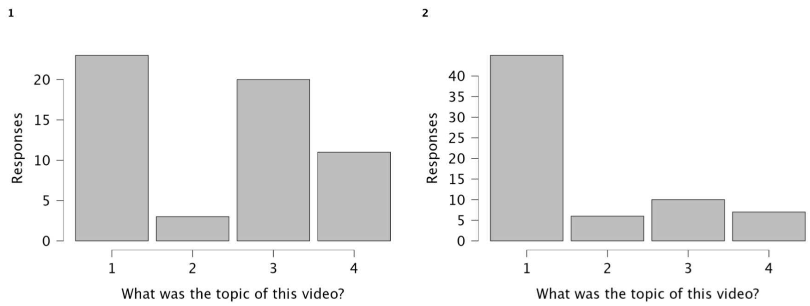
Frequencies for CQ5

VIDEO 1A/2B	CQ5	Frequency
1 Video A	1 A	32
	2 B	8
	3 C	13
	4 D	4
	Missing	0
	Total	57
2 Video B	1 A	28
	2 B	17
	3 C	17
	4 D	6
	Missing	0
	Total	68

In CQ3, and any other *Comprehension Questions*, conflicting results were seen that let to the detection of errors in the research design. Since the study at hand is a preliminary one, errors were expected and required to be corrected in further investigations. To question *"What was the topic of the video?"* 34 participants out of 57 who watched Video Format A gave an incorrect response. At the other hand, out of 68 people who watched Video Format B, 23 people gave an incorrect response. These results can be reasoned with two approaches. First, the results might be showing a cognitive overload on working memory due to excessive stimulation or second, it could be revealing the consequences of extravagant use of scientific language in creation of the questionnaire. Overall, in *Comprehension Questions* there was moderate difference between two control groups, while control group for Video Format A roughly contributing with more correct answers considering the number of participants in the control group. While full analysis can be found in the Appendix, Frequencies of CQ3 is presented in Figure 4.6.

CQ3

Figure 4.6 CQ3: *What was the topic of the video?*



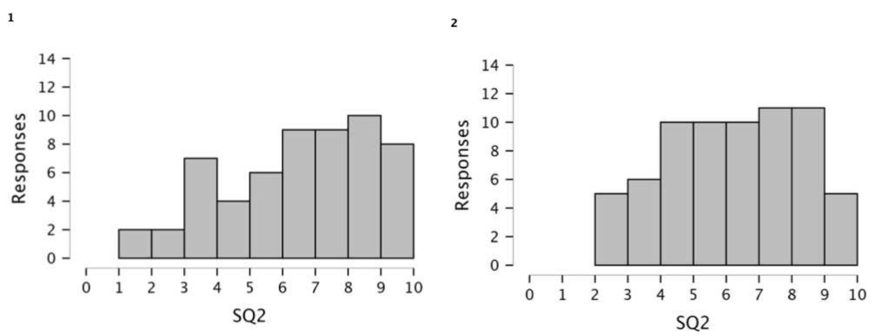
VIDEO 1A/2B	CQ3	Frequency
1	1	23
	2	3
	3	20
	4	11
	Missing	0
	Total	57
2	1	45
	2	6
	3	10
	4	7
	Missing	0
	Total	68

Lastly, when it comes to the *Viewer Satisfaction Questions,* the responses provided by both control groups reveals that Video Format A generates more focus and interest in the topic. This result can be seen in 'recommendations' section of the questionnaire. While the participants of group Video Format A commented more on details of the actual article at hand (see Rugani et. al., 2016), participants of Video Format B focused more on the quality of the editing and background music of the video when indicating recommendations. Examples from recommendations are shown on Figure 4.7. In the meantime, the distribution plots for SQ2:*"How easy it was to figure out the outcomes of the research?"* reveals that over all, participants of group Video Format A were more satisfied with the instructional video than participants of Video Format B. The trends can be found in Figure 4.8. When analysing the data in full-length, Viewer Satisfaction Questions demonstrated greater satisfaction from Video Format A (see Appendix).

Figure 4.7 *Recommendations given by members of group Video A and group Video B.*

A	*"The same experiment can be tried with more than one chick at the same time, or it can be tried as the chicks get older, so that different results or behaviors can be obtained."*
B	*"I think it would be easier for me to understand if the description of the experiment given with the video at the same time. I took my time to visualize the description of experiment. It would be easier to read and see the experiment at the same time."*
A	*"I am not sure this shows the numerical abilities. Rotation is a good idea so it is more about counting than spatial recognition. However, as the distance of the jars are the same, i felt there could be spatial recognition rather than counting."*
B	*"I think the research could be easier to comprehend if it, was explained by someone in the video rather than the viewer reading it."*
A	*"A replication study with other mammals to test the hypothesis of hemispheric processing further and to confirm results."*
B	*"Slightly slower video and descriptions to permit more time for comprehension."*

Figure 4.8 *SQ2: How easy it was to figure out the outcomes of the research?*



Frequencies for SQ2

VIDEO 1A/2B	SQ2	Frequency
1	1	2
	3	2
	4	7
	5	4
	6	6
	7	9
	8	9
	9	10
	10	8
	Missing	0
	Total	57
2	2	1
	3	4
	4	6
	5	10
	6	10
	7	10
	8	11
	9	11
	10	5
	Missing	0
	Total	68

CONCLUSION

This study explored a new approach to scientific communication. As the technology era created grounds for new forms of communication, it became crucial for the science community to adapt. Fake news (any information that does mischief with the truth) that circulates in online sources poses a great danger for the collective knowledge. To tackle this pandemic, an instructional multimedia design was constructed in consideration with seven principles from cognitive psychology to aid meaningful learning. Multimedia learning is defined as; learning from words and pictures, and multimedia instruction is presenting words and pictures that are intended to foster learning (see Mayer, 2003). To test whether suggested approach cultivates better learning, two videos were prepared for comparison. A questionnaire to capture comprehension and viewer satisfaction was administered to 125 participants through Qualtrics online survey software. Results revealed that in instructional multimedia design, consideration for cognitive capacity in working memory plays an essential role for learning. Even though minor errors were detected in the design of the questionnaire, as a preliminary study, the current paper demonstrated that high media richness, split-attention format, signaling principle, and redundancy principle were playing substantial roles in prompting learning. Whereas, classical music (Mozart's Sonata K448) as a background sound produced better focus, pop/rock genre of music was found to be distracting. Individual differences in cognitive capacity, motivation, engagement, and interest needs to be taken into account when designing an instructional multimedia video. The language chosen in the video directly affects the learning when the chosen language is secondary to the viewer since learning through secondary language requires more effort in working memory.

LIMITATIONS & SUGGESTIONS

The limitations of the current study were secondary language learning and cognitive overload along with limited participants and time. More resources are required for an extended analysis.

In further investigation, to reduce the cognitive load, *the modality principle of multimedia learning* could be given more attention along with the other principles and a version of the video with auditory instructions can be prepared. To induce attention to the viewer, a clear disclaimer of what will be seen in the video could be provided before the instructional part with a classical background music. To measure the outcomes of the multimedia learning, development of credible and valid tools of investigation is recommended.

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APPENDICES

To analyse the collected data, responses to multiple choice questions or nominal data were each assigned a number. All corresponding numbers that can be seen on the descriptive data are provided here. For example, in frequencies for gender groups divided into two are 1 = Video A and 2 = Video B, while 1 is male, 2 is female, and 3 is non binary / third gender.

Video A	1
Video B	2

A	1
B	2
C	3
D	4

18-24	4
25-34	5
35-44	6
45-54	7
55-64	8
65	9

Male	1
Female	2
Non-binary / Third gender	3

No school completed	1
High school graduate	2
Bachelor's degree	3
Master's degree	4
Doctorate degree	5

The questionnaire prepared for analysis of comprehension and viewer satisfaction can be found with the original multiple choice options can be found at the following Figure 1 and 2.

Figure 1 *Survey questions*

Comprehension & Attention (Multiple Choice)	**Viewer Satisfaction**	**Background Information**
CQ1. Which video did you just watch?	SQ1. From 1 to 10 how would you rate the quality of the video?	BQ1. How old are you?
CQ2. What did you think you just watch?	SQ2. How easy it was to figure out the outcomes of the research?	BQ2. What is your gender?
CQ3. What was the topic of this video?	SQ3. How easy it was to follow the text in the video?	BQ3. What is the highest degree of education you have completed?
CQ4. What are the implications of this research finding?	SQR. What do you suggest that we should improve? Explain with words.	BQ4.What is your current occupation?
CQ5. Choose the answer with correct order of events.	SQ4. Would you like to learn more about scientific publications with this method?	BQ5. In which country do you currently reside?
CQ6. What does the experimenter control by randomly swapping the jars?		
CQ7. In which condition the baby chick successfully locates the 4th jar from the left?		
CQ8. Which of the following is the reason that the chick selects the 4th jar from the left?		
CQ9. In the image you are seeing, which jar did the chicken actually select when it was released to the arena?		

Figure 2 *Responses to each question where the correct answer is highlighted.*

	1 A	2 B	3 C	4 D
CQ1	Video A: Descriptions were within the video.	Video B: Descriptions were given before the video.		
CQ2	A video made for entertainment purposes.	An advertisement video.	A descriptive video of research findings.	A video made for a biology lecture.
CQ3	Numerical abilities of newborn chickens.	Decision making abilities of newborn chickens.	Visual abilities of newborn chickens.	Spatial-Cognition abilities of newborn ducklings.
CQ4	Left side of the brain is in charge of numerical abilities in domestic chickens.	Which side of the brain is in charge of numerical abilities depends on each chicken.	The entire brain is in charge of numerical abilities in domestic chickens.	Right side of the brain is in charge of numerical abilities in domestic chickens.
CQ5		**Options are after the table due to heavy content.**		
CQ6	Experimenters control the duration of the test.	Experimenters control the spatial abilities of the chicken.	Experimenters control whether the line of jars is straight.	Experimenters control the local cues that the chicken might use to navigate.
CQ7	When they're using their left eye to see.	When they're using their right eye to see.	When they're released to the arena from right.	When they're released to the arena from left.
CQ8	Due to the right side dominance of the brain for numerical abilities.	Due to the position of the jars.	Due to the left side dominance of the brain for numerical abilities.	Due to the eye-patch on their eye.
CQ9	4th jar from the left.	The central jar.	4th jar from the right.	4th jar both from right and left.

Responses to CQ5:

1 A 1.Training of the chick to identify the 4th jar. 2. Testing the success of the chick to identify the 4th jar. 3. Rotation of jars. 4. Right eye-patched, left side of the brain dominant test (left eye open). 5. Left eye-patched, right side of the brain dominant test (right eye open).	**2 B** 1.Training of the chick to identify the 4th jar 2. Rotation of jars. 3. Testing the success of the chick to identify the 4th jar. 4. Right eye-patched, left side of the brain dominant test (left eye open). 5. Left eye-patched, right side of the brain dominant test (right eye open).
3 C 1.Training of the chick to identify the 4th jar 2. Testing the success of the chick to identify the 4th jar. 3. Right eye-patched, left side of the brain dominant test (left eye open). 4. Rotation of jars. 5. Left eye-patched, right side of the brain dominant test (right eye open).	**4 D** 1.Rotation of jars. 2. Training of the chick to identify the 4th jar. 3. Testing the success of the chick to identify the 4th jar. 4. Left eye-patched, right side of the brain dominant test (right eye open). 5. Right eye-patched, left side of the brain dominant test (left eye open).

- **Link to Video Format A:** https://youtu.be/M9ArvGg2JE
- **Link to Video Format B:** https://youtu.be/UB2xlk-8ISM
- Otherwise, both videos can be found at the following **Google Drive** link;

https://drive.google.com/drive/folders/1xZM0TIYHCC57_9PWuKHbjdLrlOwg_vQj?usp=sharing

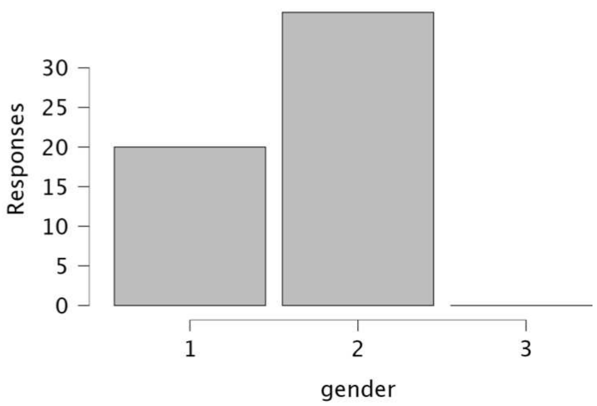
- In the following pages, descriptive data exported from JASP software is provided in detail with frequency tables and plots.
- Besides, Excel form of the exported database from Qualtrics software can be found in PDF form.
- Finally, every *'recommendation'* given by participants are attached at the end of the report.

Frequencies & Distribution Plots - Participant Background

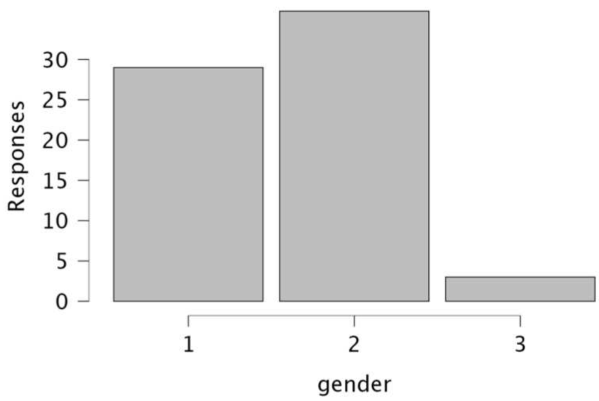
Frequencies for gender

VIDEO 1A/2B	gender	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	20	35.088	35.088	35.088
	2	37	64.912	64.912	100.000
	3	0	0.000	0.000	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	29	42.647	42.647	42.647
	2	36	52.941	52.941	95.588
	3	3	4.412	4.412	100.000
	Missing	0	0.000		
	Total	68	100.000		

1



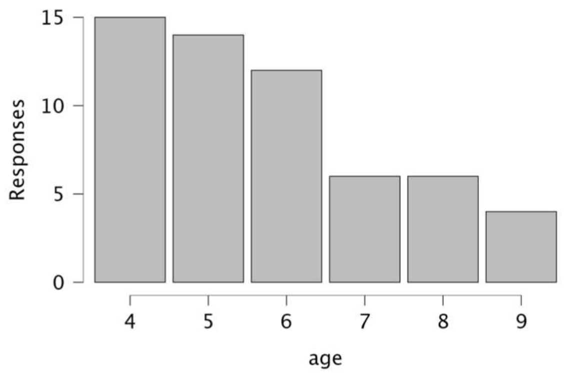
2

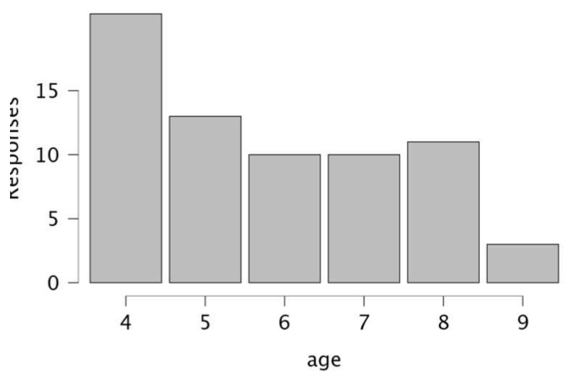


Frequencies for age

VIDEO 1A/2B	age	Frequency	Percent	Valid Percent	Cumulative Percent
1	4	15	26.316	26.316	26.316
	5	14	24.561	24.561	50.877
	6	12	21.053	21.053	71.930
	7	6	10.526	10.526	82.456
	8	6	10.526	10.526	92.982
	9	4	7.018	7.018	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	4	21	30.882	30.882	30.882
	5	13	19.118	19.118	50.000
	6	10	14.706	14.706	64.706
	7	10	14.706	14.706	79.412
	8	11	16.176	16.176	95.588
	9	3	4.412	4.412	100.000
	Missing	0	0.000		
	Total	68	100.000		

1

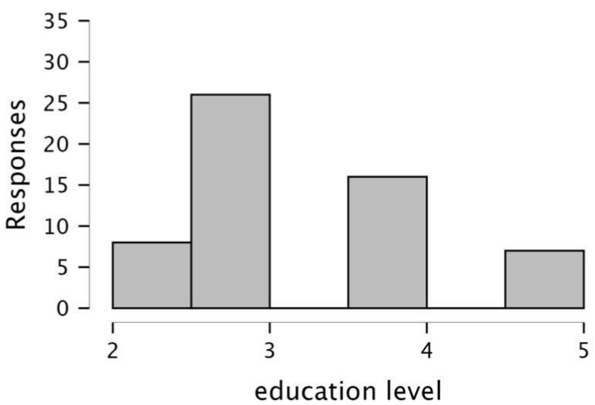




Frequencies for education level

VIDEO 1A/2B	education level	Frequency	Percent	Valid Percent	Cumulative Percent
1	2	8	14.035	14.035	14.035
	3	26	45.614	45.614	59.649
	4	16	28.070	28.070	87.719
	5	7	12.281	12.281	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	2	15	22.059	22.059	22.059
	3	35	51.471	51.471	73.529
	4	13	19.118	19.118	92.647
	5	5	7.353	7.353	100.000
	Missing	0	0.000		
	Total	68	100.000		

1



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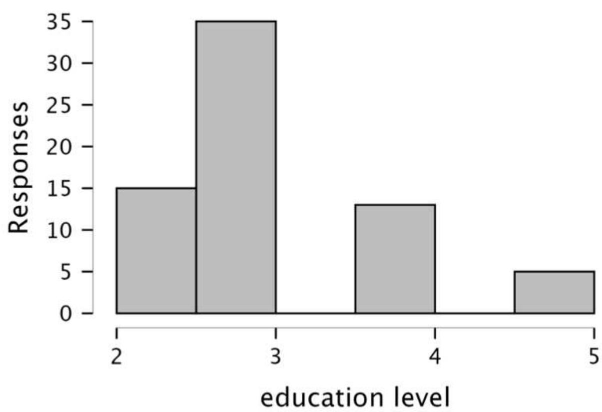


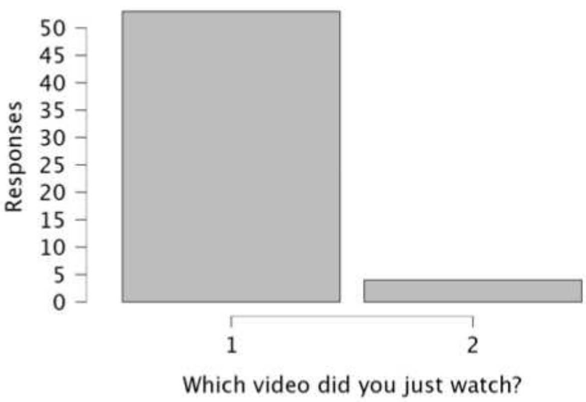
Frequencies & Distribution Plots - Comprehension Questions

Frequencies for CQ1

VIDEO 1A/2B	CQ1	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	53	92.982	92.982	92.982
	2	4	7.018	7.018	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	19	27.941	27.941	27.941
	2	49	72.059	72.059	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ1

1



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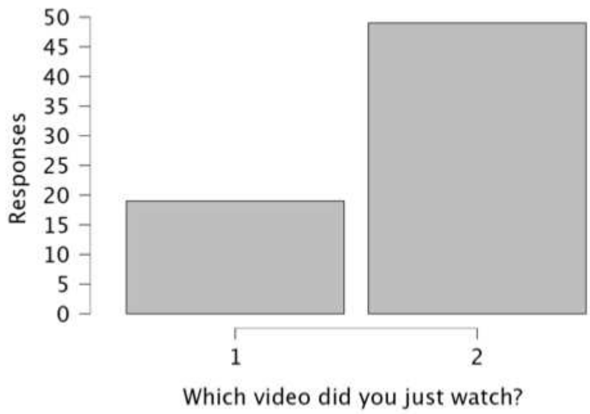


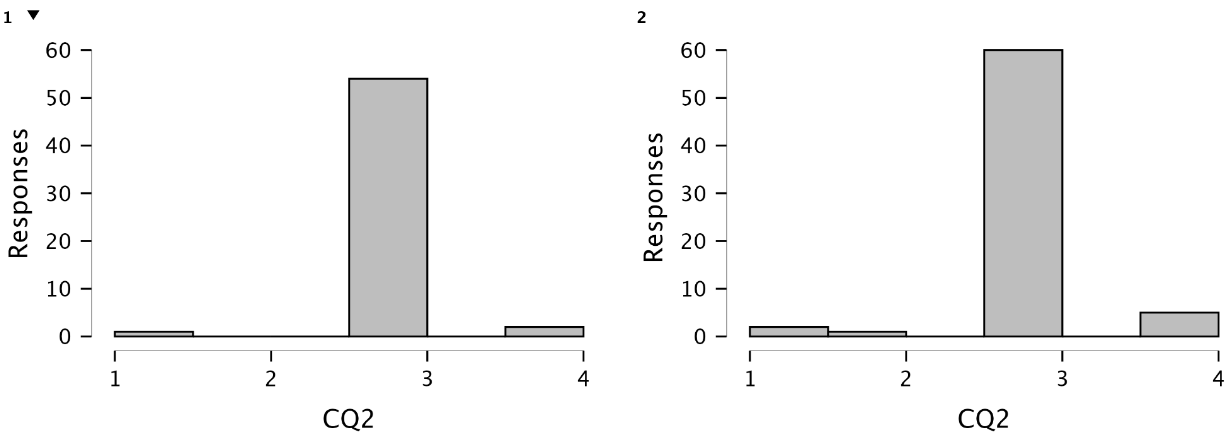
Descriptive Statistics

	CQ2		CQ3		CQ4		CQ5		CQ6		CQ7		CQ8		CQ9	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Valid	57	68	57	68	57	68	57	68	57	68	57	68	57	68	57	68
Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean	3.000	3.000	2.333	1.691	2.895	2.824	1.807	2.015	3.000	3.000	1.579	1.691	1.842	1.912	1.912	1.824
Std. Deviation	0.327	0.457	1.200	1.069	1.385	1.315	1.025	1.015	1.052	1.037	0.844	1.040	0.941	0.973	1.057	0.992
Minimum	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Maximum	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	3.000	4.000	4.000	4.000

Frequencies for CQ2

VIDEO 1A/2B	CQ2	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	1	1.754	1.754	1.754
	3	54	94.737	94.737	96.491
	4	2	3.509	3.509	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	2	2.941	2.941	2.941
	2	1	1.471	1.471	4.412
	3	60	88.235	88.235	92.647
	4	5	7.353	7.353	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ2

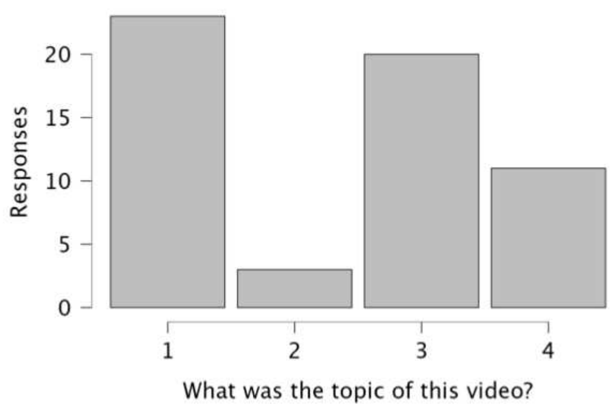


Frequencies for CQ3

VIDEO 1A/2B	CQ3	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	23	40.351	40.351	40.351
	2	3	5.263	5.263	45.614
	3	20	35.088	35.088	80.702
	4	11	19.298	19.298	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	45	66.176	66.176	66.176
	2	6	8.824	8.824	75.000
	3	10	14.706	14.706	89.706
	4	7	10.294	10.294	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ3

1



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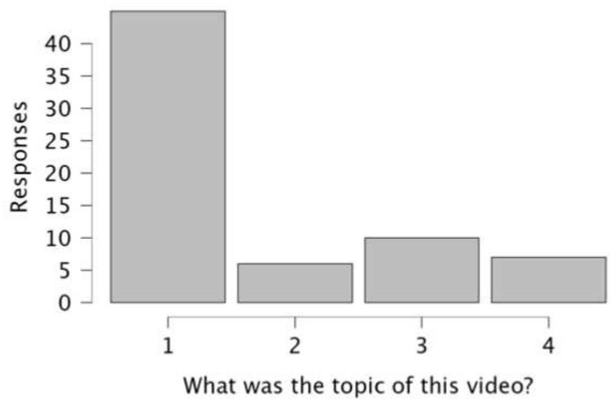
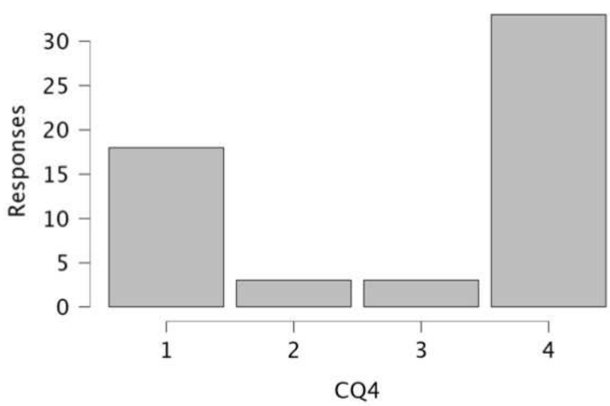


Frequencies for CQ4

VIDEO 1A/2B	CQ4	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	18	31.579	31.579	31.579
	2	3	5.263	5.263	36.842
	3	3	5.263	5.263	42.105
	4	33	57.895	57.895	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	19	27.941	27.941	27.941
	2	8	11.765	11.765	39.706
	3	7	10.294	10.294	50.000
	4	34	50.000	50.000	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ4

1



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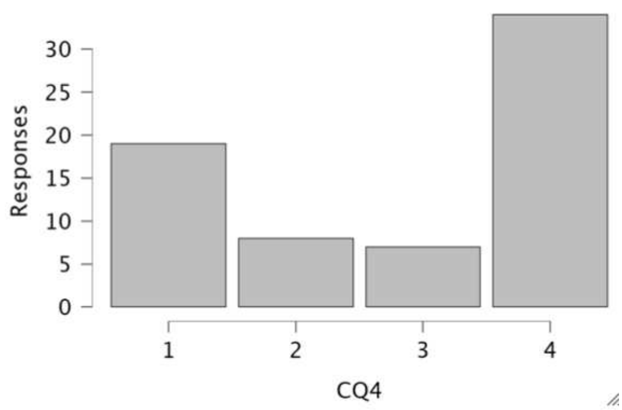
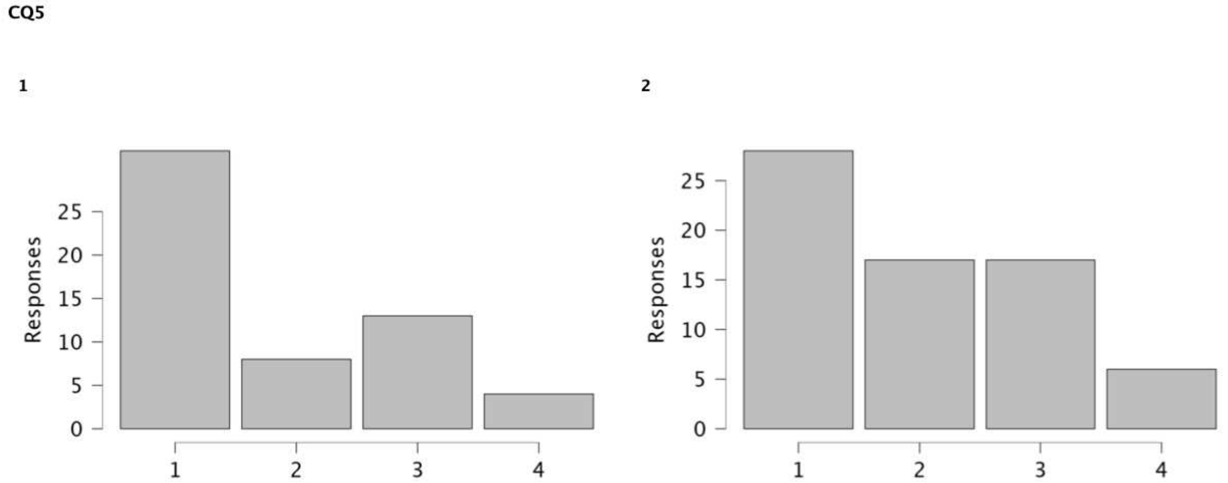


Frequencies for CQ5

VIDEO 1A/2B	CQ5	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	32	56.140	56.140	56.140
	2	8	14.035	14.035	70.175
	3	13	22.807	22.807	92.982
	4	4	7.018	7.018	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	28	41.176	41.176	41.176
	2	17	25.000	25.000	66.176
	3	17	25.000	25.000	91.176
	4	6	8.824	8.824	100.000
	Missing	0	0.000		
	Total	68	100.000		

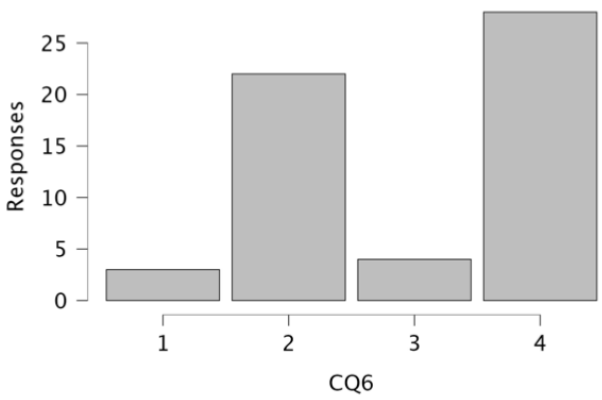


Frequencies for CQ6

VIDEO 1A/2B	CQ6	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	3	5.263	5.263	5.263
	2	22	38.596	38.596	43.860
	3	4	7.018	7.018	50.877
	4	28	49.123	49.123	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	4	5.882	5.882	5.882
	2	24	35.294	35.294	41.176
	3	8	11.765	11.765	52.941
	4	32	47.059	47.059	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ6

1



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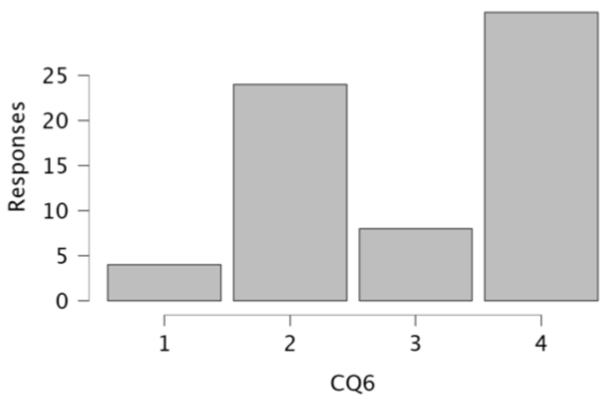
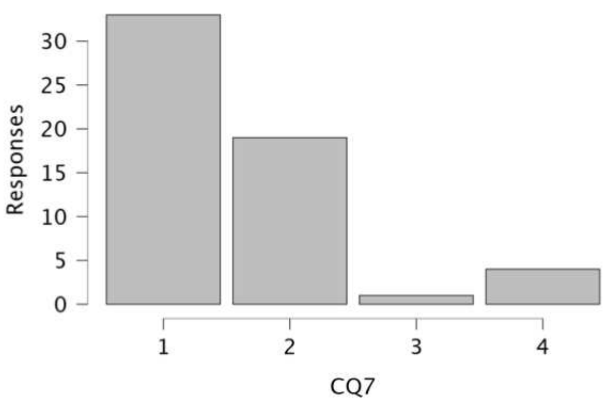


Frequencies for CQ7

VIDEO 1A/2B	CQ7	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	33	57.895	57.895	57.895
	2	19	33.333	33.333	91.228
	3	1	1.754	1.754	92.982
	4	4	7.018	7.018	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	41	60.294	60.294	60.294
	2	16	23.529	23.529	83.824
	3	2	2.941	2.941	86.765
	4	9	13.235	13.235	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ7

1



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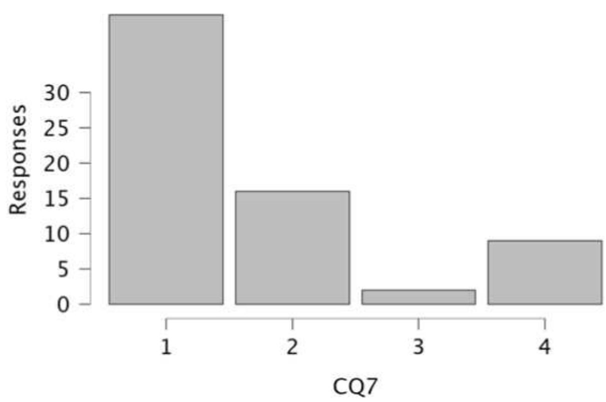
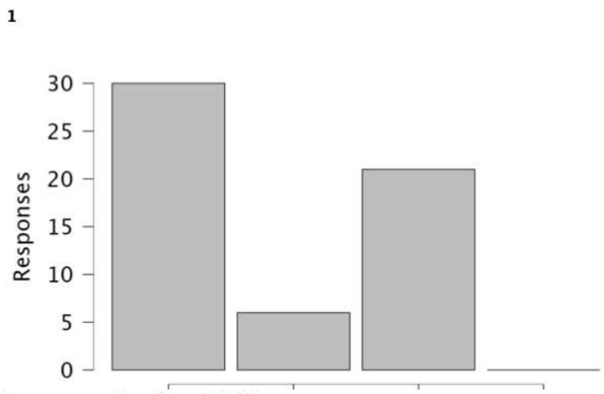
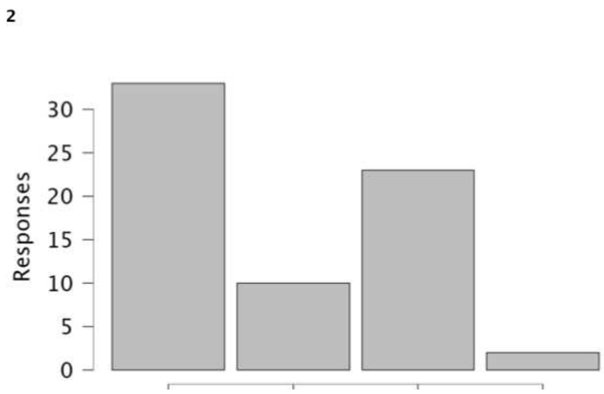


Frequencies for CQ8

VIDEO 1A/2B	CQ8	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	30	52.632	52.632	52.632
	2	6	10.526	10.526	63.158
	3	21	36.842	36.842	100.000
	4	0	0.000	0.000	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	33	48.529	48.529	48.529
	2	10	14.706	14.706	63.235
	3	23	33.824	33.824	97.059
	4	2	2.941	2.941	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ8

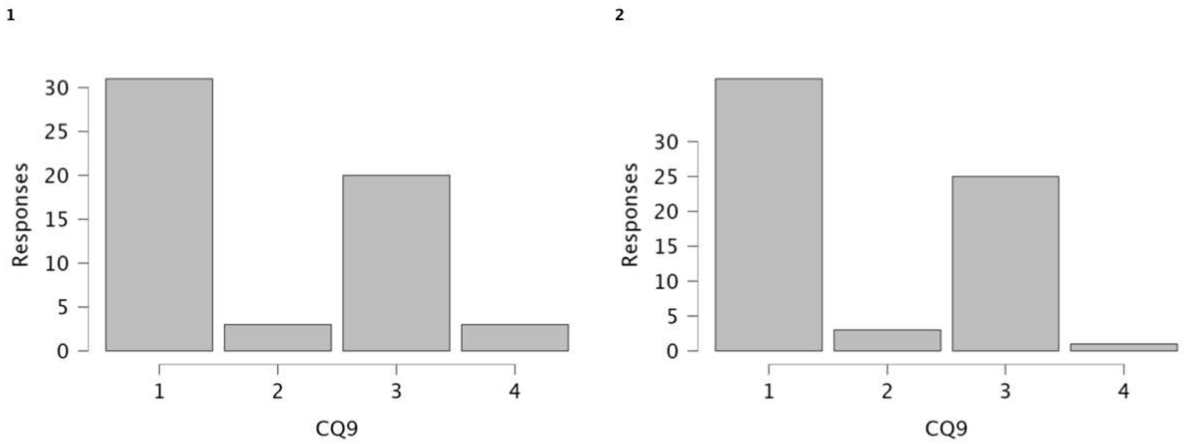




Frequencies for CQ9

VIDEO 1A/2B	CQ9	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	31	54.386	54.386	54.386
	2	3	5.263	5.263	59.649
	3	20	35.088	35.088	94.737
	4	3	5.263	5.263	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	39	57.353	57.353	57.353
	2	3	4.412	4.412	61.765
	3	25	36.765	36.765	98.529
	4	1	1.471	1.471	100.000
	Missing	0	0.000		
	Total	68	100.000		

CQ9



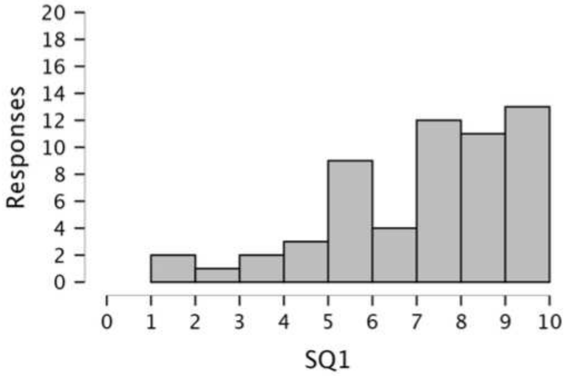
Frequencies & Distribution Plots - Viewer Satisfaction Questions

Frequencies for SQ1

VIDEO 1A/2B	SQ1	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	1	1.754	1.754	1.754
	2	1	1.754	1.754	3.509
	3	1	1.754	1.754	5.263
	4	2	3.509	3.509	8.772
	5	3	5.263	5.263	14.035
	6	9	15.789	15.789	29.825
	7	4	7.018	7.018	36.842
	8	12	21.053	21.053	57.895
	9	11	19.298	19.298	77.193
	10	13	22.807	22.807	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	2	1	1.471	1.471	1.471
	3	2	2.941	2.941	4.412
	4	2	2.941	2.941	7.353
	5	8	11.765	11.765	19.118
	6	4	5.882	5.882	25.000
	7	14	20.588	20.588	45.588
	8	16	23.529	23.529	69.118
	9	7	10.294	10.294	79.412
	10	14	20.588	20.588	100.000
	Missing	0	0.000		
	Total	68	100.000		

SQ1

1



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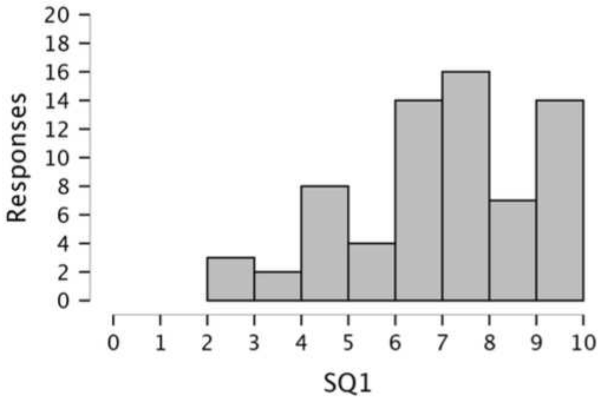
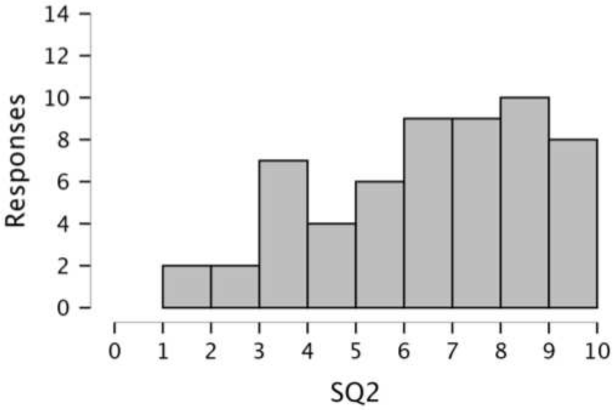


Frequencies for SQ2

VIDEO 1A/2B	SQ2	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	2	3.509	3.509	3.509
	3	2	3.509	3.509	7.018
	4	7	12.281	12.281	19.298
	5	4	7.018	7.018	26.316
	6	6	10.526	10.526	36.842
	7	9	15.789	15.789	52.632
	8	9	15.789	15.789	68.421
	9	10	17.544	17.544	85.965
	10	8	14.035	14.035	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	2	1	1.471	1.471	1.471
	3	4	5.882	5.882	7.353
	4	6	8.824	8.824	16.176
	5	10	14.706	14.706	30.882
	6	10	14.706	14.706	45.588
	7	10	14.706	14.706	60.294
	8	11	16.176	16.176	76.471
	9	11	16.176	16.176	92.647
	10	5	7.353	7.353	100.000
	Missing	0	0.000		
	Total	68	100.000		

SQ2

1



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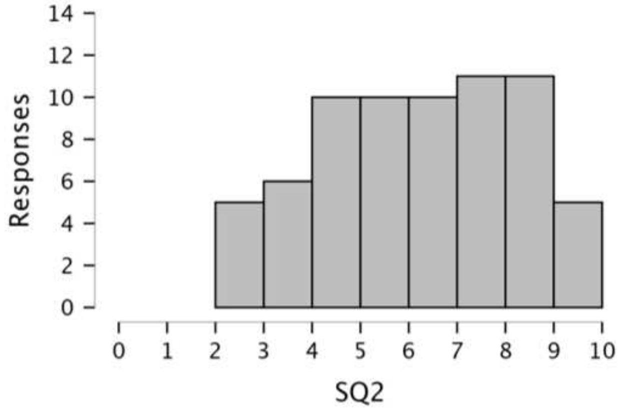
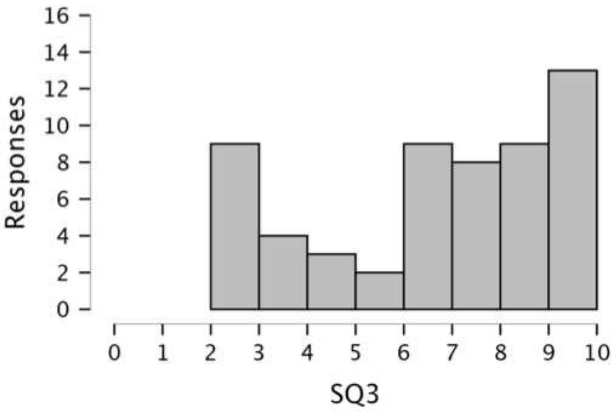


Frequencies for SQ3

VIDEO 1A/2B	SQ3	Frequency	Percent	Valid Percent	Cumulative Percent
1	2	4	7.018	7.018	7.018
	3	5	8.772	8.772	15.789
	4	4	7.018	7.018	22.807
	5	3	5.263	5.263	28.070
	6	2	3.509	3.509	31.579
	7	9	15.789	15.789	47.368
	8	8	14.035	14.035	61.404
	9	9	15.789	15.789	77.193
	10	13	22.807	22.807	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	1	1.471	1.471	1.471
	2	3	4.412	4.412	5.882
	3	5	7.353	7.353	13.235
	4	4	5.882	5.882	19.118
	5	17	25.000	25.000	44.118
	6	10	14.706	14.706	58.824
	7	6	8.824	8.824	67.647
	8	9	13.235	13.235	80.882
	9	8	11.765	11.765	92.647
	10	5	7.353	7.353	100.000
	Missing	0	0.000		
	Total	68	100.000		

SQ3

1



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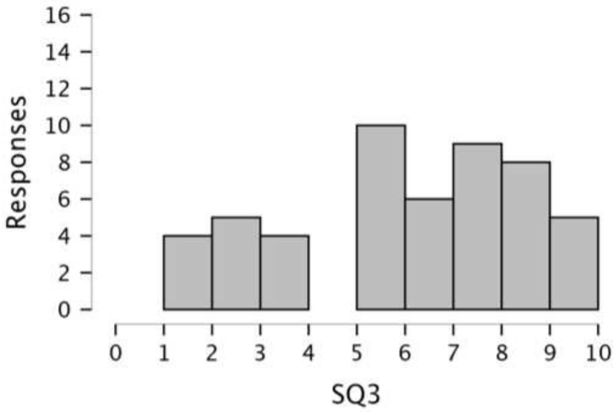
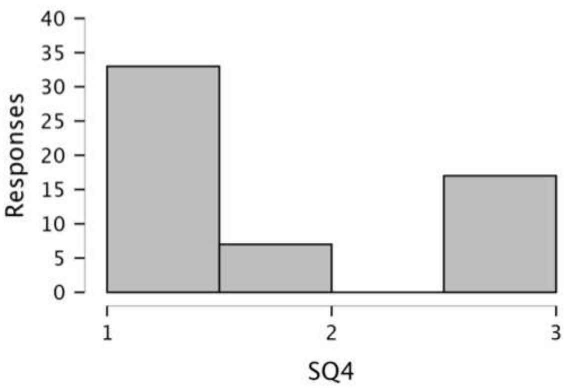


Frequencies for SQ4

VIDEO 1A/2B	SQ4	Frequency	Percent	Valid Percent	Cumulative Percent
1	1	33	57.895	57.895	57.895
	2	7	12.281	12.281	70.175
	3	17	29.825	29.825	100.000
	Missing	0	0.000		
	Total	57	100.000		
2	1	37	54.412	55.224	55.224
	2	7	10.294	10.448	65.672
	3	23	33.824	34.328	100.000
	Missing	1	1.471		
	Total	68	100.000		

SQ4

1



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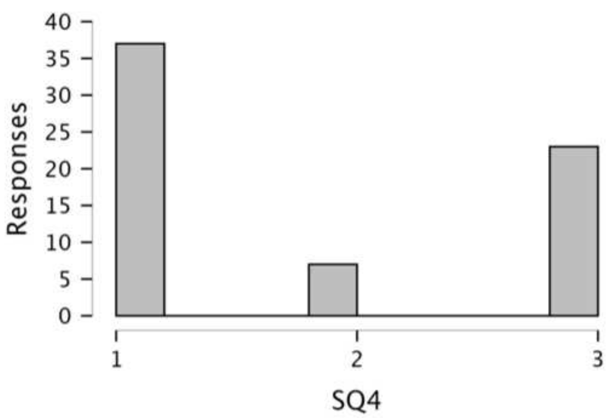

Participant Recommendations

Group A is highlighted in red while Group B is highlighted in green.

1	1	
2	2	I think it would be easier for me to understand if the description of the experiment given with the video at the same time. I am take my time visualize the description of experiment. It would be easier to read and see the experiment at the same time.
3	2	texts were too long and the whole video didn't fit my mobile screen so I had to pause and scroll side to side each time
4	1	
5	1	
6	1	Give time for people to read the text on the screen by adding little bit of time
7	1	
8	2	
9	2	Less written explanation
10	1	
11	1	The same experiment can be tried with more than one chick at the same time, or it can be tried as the chicks get older, so that different results or behaviors can be obtained.
12	2	Maybe adding more information of the hypothesis.
13	1	Better texting maybe, more visual fonts
14	1	i think it was great
15	1	you should find some left-brained chicks
16	2	Audio description not only written
17	2	I couldn't see the worms properly, so maybe put some colour on video on the spot where they put the worm, so that i,Äôm sure the chicken is doing right.
18	2	
19	2	text embedded to video and image quality
20	2	I think the research could be easier to comprehend if it's explained by someone in the video rather than the viewer reading it.
21	1	The texts can stay on the screen longer to resd more carefully, i had to stop several to read it:)
22	2	More testing repetition
23	2	it is enough
24	2	
25	2	If the description were given in the videos, before each step it would be more helpful and easier to follow
26	1	Nothing to improve in the survey and experiment. Brilliant.
27	1	It was brilliant nothing to be improved.
28	2	Non
29	2	Maybe to put some little tips during the video of the animal in order to better follow the experiment, because it can happen that the explanation before the video can,Äôt be 100% remembered
30	2	More time to read for the text part, number of tests made, number of chicks used,
31	1	
32	2	Nothing
33	1	I could not see the whole scene from my phone.
34	2	
35	2	
36	2	The video angle should be more convenient for the watcher to comprehend. The video should be able to state on which eye is the patch located. The phase change on each step of the process should be added on the video as text.
37	1	
38	2	Need a non-effected control group, who've not learned to choose the 4th. What are they doing without learning? They must randomly choose the closest one with the worm I think.
39	1	equipment
40	1	Written explantions was far at the corner of the frame and wasn't readable at all!!!
41	1	
42	2	
43	1	
44	2	Slightly slower video and descriptions to permit more time for comprehension.
45	2	
46	1	
47	2	Video quality
48	1	It was difficult for me to understand how the brain works. Left and right parts of the brain and their ability to do things were always confusing for me and it is hard to remember. I believe giving us more time for them would help us to remember the info more. Visuals can b
49	1	
50	2	Daha net gorsel
51	1	Everything
52	1	Description clarity
53	2	Was perfect
54	1	
55	2	There should be a warning that It is not ethically correct to use animals on experiments. All chicks' right to live and health is guaranteed. This experiment has just been produced to measure/improve the eyesight of chickens.
56	2	for non naitiv english speakers explanation text could stay longer
57	2	Natives read fast, others can't. You can decrease the text speed may be and you can also mention the smelling abilities of the chicks, too.
58	1	I am not sure this shows the numerical abilities. Rotation is a good idea sonit is more about counting than spatial recognition. However, as the distance of the jars are the same, i felt there could be spatial recognition rather than counting.
59	1	Mobile compatibility. I couldn't even read the text properly.
60	1	Text following in the video
61	1	
62	2	Our attention (about text and video correlation)
63	2	Performing more exercises
64	1	It was hard to read the lines in the video
65	1	Nothing
66	1	nothing
67	1	
68	2	
69	1	
70	2	Considering the participants language ability, video may be a bit slow to give enough time to read the explanations
71	1	Slower
72	1	Text could be bigger and fully visibleand repeat the test by high number of chickens
73	1	The text and duration of the video
74	2	It would better to use external voice for information transfer to us
75	2	Nothing
76	2	Observation
77	1	Explaining the video more
78	2	It was kind of jarring that there was no music in the first half and then music in the second half. It also probably would be easier to retain if the text for each step was right before the video of that step.
79	1	videos shot with a better angle
80	2	Would be a little bit longer time to read for people who are not native English language speakers
81	2	
82	1	I think the experiment was giving great information. Maybe we could see more baby chickens to make the experiment more definite.
83	2	
84	1	-
85	2	-
86	2	reading the text during the video

87	2	
88	1	More clear explanations are needed after 90 degree rotation (just before eye patch test)
89	1	A replication study with other mammals to test the hypothesis of hemispheric processing further and to confirm results
90	1	Video text
91	2	
92	2	.
93	1	The quality of the video could use some improvement
94	2	Q
95	2	the explanations can stay longer in the video
96	2	
97	2	The music could have been more intriguing, like a soundtrack of Hans Zimmer
98	2	
99	1	
100	1	
101	2	You must give more information about the brain in the text
102	2	The text was too difficult to understand.
103	2	Ouch. Now I really appreciate scientific papers, even more so than ever before. The text was politician-like (lots of yadda yadda with rare scattered genuine information), I turn up the sound, nothing... BANG, I am hit with the worst of the worst in obnoxious noise terror:
104	1	Repeat the last information section 2 times
105	2	Easy question
106	1	No further improvements are necessary
107	2	
108	2	
109	1	No improvement needed
110	2	
111	1	
112	2	More descriptive on methods
113	2	The image and the text doesn't fit on screen of my iphone
114	1	N/A
115	1	n/a
116	1	
117	2	I am not sure
118	2	I dont have an idea
119	2	I suggest you choose a more vibrant color for the eye band of the chicks in the video. In the video, the right side for you was the left side for me. You should have specified this part at the beginning of the video or you should have said right and left according to the video.
120	2	nothing
121	1	
122	1	Use a different differentiator for left/right jar and left/right eye and left/right brain
123	2	More time for reading text as it can be a lot of experiment detail to take in. Identifying in the video where the worm was more than once would be helpful due to change in direction
124	2	Slower text at the start
125	2	Improve the clarity of the written explanations and make them more concise