

Impacts of diagram design on comprehension

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Introduction

Science graphics are used in textbooks and museum settings to assist understanding. However, graphics could confuse the audience depending on their context.

Clutter is the state in which excess items, or their representation or organization, lead to a degradation of performance at some task (Rosenholtz et al., 2005). When this happens to visuals, it is called visual clutter. According to research on visual clutter, the simpler the figure, the easier it is to understand. In addition, Cognitive Load Theory (CLT) also states that extraneous load must be reduced by good design to create more effective and valuable teaching materials (Reedy, 2015).

On the other hand, studies have shown that information appearing in more familiar contexts is better learned and recalled (Song & Bruning, 2015). This could be explained by the framework of Schema Theory (ST).

This project aims to explore the interplay between these apparently contradicting frameworks, visual clutter and CLT versus ST, within the context of a specific design choice. This study compared participant comprehension from two different morphological figures of chickens. The first figure was a skeletal diagram and the second was a silhouetted figure. Better comprehension from the skeletal figure would provide support for simpler diagram as suggested by the visual clutter literature, and CLT. However, higher levels of comprehension from the silhouetted skeletal figure might suggest that inclusion of context leads to improved comprehension in line with ST.

Material & Methods

Two types of morphological figures of chickens were prepared—a skeletal figure and a silhouetted skeletal figure (See Fig 1). A total of 153 participants were recruited from undergraduate and graduate programs in Japan and the United States, Participants were randomly assigned to one of the figures. After seeing the figure, participants were asked to answer a series of questions to evaluate their comprehension of these figures. To evaluate the impact of diagram design on different levels of comprehension, three types of questions were prepared: Recall questions, asking the name of the bones; Function questions, asking the function of bones, and Homology questions, asking the corresponding bones with humans. The total number of correct answers for each section was compared between groups using the statistical software package JASP.

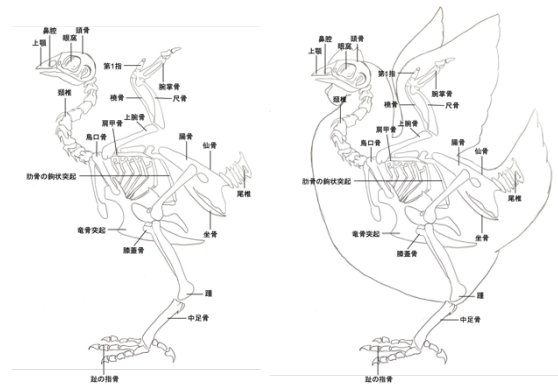


Figure 1. Skeletal (left) and Silhouetted Skeletal (right) morphological figures of chicken

Result

Mean total scores and standard deviations were calculated for each group and section (See Table1). Since comprehension data collected was not normally distributed the non-parametric Mann-Whitney test was used to compare mean totals. The p-value for the Recall section was 0.41, Function section was 0.68, and the Homology section was 0.98. Therefore, the results did not reveal any statistically significant differences between the two groups.

Table 1. Descriptive Statistics

Descriptive Statistics	Recall		Function		Homology	
	Skeletal	Silhouetted	Skeletal	Silhouetted	Skeletal	Silhouetted
Mean	6.403	6.070	6.134	6.058	4.119	4.093
Std. Deviation	2.374	2.580	2.052	2.031	1.737	1.685

Discussion

The Mann-Whitney test has revealed that there is no significant difference between people’s comprehension on the two types of diagrams. However, due to insufficient statistical power (0.2) it was not possible to draw reliable conclusions from this data. To be certain with the results, you need to have more participants. In addition, the survey only asks three types of questions to address people’s comprehension. This limitation of research design might had influenced the results.

References

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