

# Expressiveness-Effectiveness Score (EES) and Examples

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## 1 Expressiveness-Effectiveness Score (EES)

We defined a heuristic evaluation metric that we call the *Expressiveness-Effectiveness Score (EES)*. The score attempts to measure if the participants were able to encapsulate a specific domain task (effectiveness) and how well they did (roughly using the language of Mackinlay’s APT). Essentially, the EES intends to reflect on how well does a visualization fulfill a required domain task. Therefore, in order to determine the EES of a visualization, a set of domain tasks are required.

The EES of a visualization can range from 0 to 3 according to the following rubric:

- *EES=0: information is not expressed in the design.*
- *1: information expressed, but requires significant effort to decode.*
- *2: information expressed, but requires effort to decode.*
- *3: information expressed and is easy to decode.*

### 1.1 Simple Example

We use a column chart as an example to demonstrate the scoring process of EES(Figure 1). In the example, x axis contains 4 categorical data and y axis visualize the value respect to these categories. All data used come from a certain categorical data (i.e., Month 1). One can imagine that these four categories represent products(e.g., apple, orange etc.), and the height of column represent their associated prices in a certain month of the year.

In this visualization, it is impossible to *determine if the value associated a category is changed in the next month*(e.g., what’s the price of apple in Month 2?). Therefore, the domain task is not fulfilled and no information is expressed in the design about this task. Therefore, for this task, this column chart receives the score of 0.

If the domain task is “*finding the average value of all the data*”, this column chart receives a score of 1 because (1) it is possible to find the average value of all data and (2) the finding process requires significant effort as readers need to first estimate the value of each column, then calculate the average. If the columns are labeled with specific value, this visualization could have received a score of 2 for this domain task.

For the domain task that “*finding the category that is associated with the 3rd highest value*”, this column chart receives a score of 2 because (1) the information is expressed (2) users can find the 3rd highest value by comparing all values. If the columns are ranked by their values, this visualization could have received a score of 3.

For the domain task that “*finding the category that is associated with the largest value*”, this visualization receive the score of 3 because the highest value is easy to find.

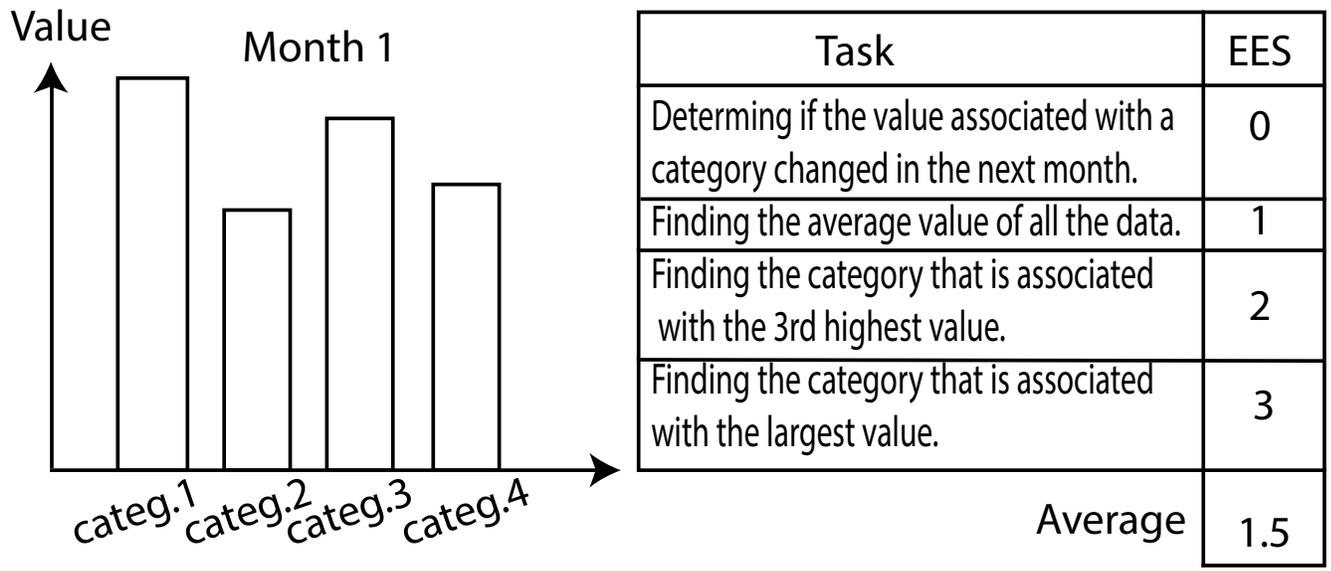


Figure 1: Example grading of Average Expressiveness-Effectiveness Score.

If the visualization intends to perform all four domain tasks, the EES of this visualization is the average EES of all tasks ( $\frac{0+1+2+3}{4} = 1.5$ ).