Supplemental Material

for

IEEE InfoVis 2016 Paper

VLAT: Development of a Visualization Literacy Assessment Test

Sukwon Lee, Sung-Hee Kim, and Bum Chul Kwon, Member, IEEE

This supplemental material contains:

- (1) The full rank of data visualization types in Source 2 (data visualization authoring tools) and Source 3 (news outlets).
- (2) The test instructions and all the 53 test items in the VLAT with associated data visualizations, stems, and options.
- (3) The summary table of difficulty indexes (*P*) by data visualization types and by visualization tasks.

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Map 1 Org Chart 1	Diff Chart			
Org Chart 1				
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Full Rank of Data Visualization Types in Source 2 and Source 3

Instructions for the Test

Please carefully read the following instructions before starting the test.

- The primary purpose of this test is to measure the ability to read and interpret visually represented data of users, especially non-experts in data visualization. The test contains 53 multiple-choice questions about 12 graphs/charts.
- 2. After you read these instructions, you will see the questions one by one with a graph/chart in a randomized order.
- 3. Select the **BEST** answer to the questions. You will be allowed **a maximum of 25 seconds** to answer to a question (a maximum of 22 minutes in total to complete the test).
- 4. **DO NOT GUESS**. Please select the "**Omit**" option if you are not sure about your answer or your answer is based on a guess. Some points will be deducted for a wrong answer and the score would be corrected for guessing.

Item 1 Monthly Oil Price History in 2015



What was the price of a barrel of oil in February 2015?

\$57.36	
\$47.82	
\$50.24	
\$39.72	
Omit	

Item 2 Monthly Oil Price History in 2015



In which month was the price of a barrel of oil the lowest in 2015?

March
May
July
December
Omit

Item 3 Monthly Oil Price History in 2015



What was the price range of a barrel of oil in 2015?

\$35 - \$65
\$48.36 - \$60.95
\$37.04 - \$48.36
\$37.04 - \$60.95
Omit

Item 4 Monthly Oil Price History in 2015



Over the course of the second half of 2015, the price of a barrel of oil was _____

rising		
falling		
staying		
Omit		

Item 5 Monthly Oil Price History in 2015



About how much did the price of a barrel of oil fall from April to September in 2015?

\$4	
\$15	
\$17	
\$45	
Omit	

Item 6 Average Internet Speeds in Asia



What is the average internet speed in Japan?

10 Mbps	
14 Mbps	
15 Mbps	
16 Mbps	
Omit	

Item 7 Average Internet Speeds in Asia



In which country is the average internet speed the fastest in Asia?

China
Hong Kong
South Korea
Vietnam
Omit

Item 8 Average Internet Speeds in Asia



What is the range of the average internet speed in Asia?

0 - 22 Mbps

2 - 20.5 Mbps

3 - 20 Mbps

3.4 - 7.8 Mbps

Omit

Item 9 Average Internet Speeds in Asia



How many countries in Asia is the average internet speed slower than Thailand?

5 countries	
6 countries	
7 countries	
8 countries	
Omit	

Item 10 Hotel Costs of Room Service



What is the cost of peanuts in Las Vegas?

\$12			
\$16.7			
\$23.4			
\$35.4			
Omit			

Item 11 Hotel Costs of Room Service



About what is the ratio of the cost of a sandwich to the total cost of room service in Seattle?

1 to 10	
2 to 10	
4 to 10	
6 to 10	
Omit	

Item 12 Hotel Costs of Room Service



In which city is the cost of soda the highest?

New York City
Las Vegas
Atalanta
Washington D.C.
Omit

Item 14 Hotel Costs of Room Service



The cost of vodka in Atlanta is higher than that of Honolulu.

True	
False	
Omit	

Item 15 Hotel Costs of Room Service



The ratio of the cost of Soda to the cost of Water in Orlando is higher than that of Washington D.C.

True			
False			
Omit			

Item 16 Election Exit Poll of California State by Education



What is the approval rating of Republicans among the people who have the education level of Postgraduate Study?

38%		
47%		
53%		
62%		
Omit		

Item 17 Election Exit Poll of California State by Education



What is the education level of people in which the Democrats have the lowest approval rating?

High School Graduate or Less
Some College Degree
College Graduate
Postgraduate study
Omit

Item 18 Election Exit Poll of California State by Education



The approval rating of Republicans for the people who have the education level of Some College Degree is lower than that for the people who have the education level of Postgraduate Study.

True			
False			
Omit			
onne			

Item 19 Global Smartphone Market Share (%)



About what is the global smartphone market share of Samsung?

15%	
25%	
33%	
50%	
Omit	

Item 20 Global Smartphone Market Share (%)



In which company is the global smartphone market share the smallest?

Apple	
Xiaomi	
Lenovo	
Others	
Omit	

Item 21 Global Smartphone Market Share (%)



The global smartphone market share of Apple is larger than that of Huawei.

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alse
nit

Item 22 Taxi Passenger Ratings



How many people have rated the taxi between 4.0 and 4.2?

145	
153	
200	
240	
Omit	

Item 23 Taxi Passenger Ratings



What is the rating that the people have rated the taxi the most?

4.2 - 4.4	
4.4 - 4.6	
4.6 - 4.8	
4.8 - 5.0	
Omit	

Item 25 Taxi Passenger Ratings



More people have rated the taxi between 4.6 and 4.8 than between 4.2 and 4.4.

True			
False			
Qualit			
Omit			

Item 27 Height vs. Weight of 85 Males



What is the weight for the person who is 165.1 cm tall?

53.9 kg	
67.7 kg	
70.5 kg	
82.7 kg	
Omit	

Item 28 Height vs. Weight of 85 Males



What is the height for the tallest person among the 85 males?

175.3 cm	
192 cm	
197.1 cm	
200 cm	
Omit	

Item 29 Height vs. Weight of 85 Males



What is the range in weight for the 85 males?

40 - 130 kg
62.3 - 90.9 kg
53.9 - 102.3 kg
53.9 - 123.6 kg
Omit

Item 31 Height vs. Weight of 85 Males



What is the height for a person who lies outside the others the most?

167.4 cm	
175.3 cm	
193 cm	
197.1 cm	
Omit	

Item 32 Height vs. Weight of 85 Males



A group of males are gathered around the height of 176 cm and the weight of 70 kg.

True	
E.L.	
False	
Omit	

Item 33 Height vs. Weight of 85 Males



There is a negative linear relationship between the height and the weight of the 85 males.

True			
False			
Omit			

Item 34 Height vs. Weight of 85 Males



The weights for males with the height of 188 cm are all the same.

True			
False			
Omit			

Item 35 Average Coffee Bean Price from 2013 to 2014



What was the average price of a pound of coffee beans in September 2013?

\$4.9	
\$5.0	
\$5.1	
\$5.2	
Omit	

Item 36 Average Coffee Bean Price from 2013 to 2014



When was the average price of a pound of coffee beans at minimum?

April 2013	
September 2013	
June 2014	
December 2014	
Omit	

Item 37 Average Coffee Bean Price from 2013 to 2014



What was the range of the average price of a pound of coffee beans between January 2013 and December 2014?

\$4.4 - \$6.2	
\$4.6 - \$5.9	
\$4.6 - \$6.0	
\$4.6 - \$6.1	
Omit	
Item 38 Average Coffee Bean Price from 2013 to 2014



Over the course of 2013, the average price of a pound of coffee beans was _____

rising			
falling			
staying			
Omit			

Item 40 Popular Girls' Names in the UK



What was the number of girls named 'Amelia' in 2010 in the UK?

1,500			
3,800			
4,200			
8,000			
Omit			

Item 41 Popular Girls' Names in the UK



About what was the ratio of the number of girls named 'Olivia' to those named 'Isla' in 2014 in the UK?

1 to 1			
1 to 2			
1 to 3			
1 to 4			
Omit			

Item 42 Popular Girls' Names in the UK



Over the course of years between 2009 and 2014, when was the number of girls named 'Amelia' at the maximum?

2009	
2011	
2012	
2014	
Omit	

Item 44 Popular Girls' Names in the UK



The number of girls named 'Isla' was _____ from 2009 to 2012.

rising			
falling			
staying			
Omit			

Item 45 Popular Girls' Names in the UK



In the UK, the number of girls named 'Amelia' in 2014 was more than it was in 2013,

True	
False	
Omit	
Offic	

Item 46 Popular Girls' Names in the UK



Over the course of years between 2009 and 2014, the number of girls named 'Isla' was always more than 'Olivia'.

True			
Foloo			
False			
Ourrit			
Omit			

Item 47 Metro Systems of the World



What is the total length of the metro system in Beijing?

330 km			
400 km			
530 km			
560 km			
Omit			

Item 48 Metro Systems of the World



Which city's metro system has the largest number of stations?

Seoul
Beijing
New York City
Shanghai
Omit

Item 49 Metro Systems of the World



What is the range of the total length of the metro systems?

150 - 600 km
240 - 380 km
240 - 560 km
180 - 560 km
Omit

Item 51 Metro Systems of the World



Which city's metro system does lie outside the relationship between the total system length and the number of stations most?

Токуо
New York City
Beijing
London
Omit

Item 52 Metro Systems of the World



A group of the metro systems of the world has approximately 300 stations and around a 200 km system length.

True			
False			
Omit			

Item 53 Metro Systems of the World



In general, the ridership of the metro system increases as the number of stations increases.

True			
False			
Omit			

Item 54 Metro Systems of the World



The metro system in Shanghai has more ridership than the metro system in Beijing.

True			
False			
Omit			

Item 55 Unemployment Rates for States in 2015



What was the unemployment rate for Indiana (IN) in 2015?

1.1% - 2.3%	
2.3% - 3.4%	
3.4% - 4.6%	
4.6% - 5.7%	
Omit	

Item 56 Unemployment Rates for States in 2015



In which state was the unemployment rate the highest in 2015?

Alaska (AK)
New Mexico (NM)
Florida (FL)
New York (NY)
Omit

Item 57 Unemployment Rates for States in 2015



In 2015, the unemployment rate for Washington (WA) was higher than that of Wisconsin (WI).

True	
False	
Omit	

Item 59 The Number of Unique Visitors for Websites in 2010

Websites								
Financia	I		Social Media			Search		
Citibank		PayPal	Classmates	Facebook		Ask	Bing	Google
Experiar	n Bank of America		LinkedIn					
Compute	ər							
	Samsung Ap	ople	Twitter			AOL		
Dell			Retail					
			Sears	eBay	Amazon			
			Best Buy	-		Yahoo!		
News								
Fox Nev	vs CBS	Fox Media	Target					
NBC Universa NY Time	es		Craigslist					
ESPN	CNN		Wal-Mart					

For which website was the number of unique visitors the largest in 2010?

Facebook	
Amazon	
Bing	
Google	
Omit	

Item 60 The Number of Unique Visitors for Websites in 2010

Websites			
Financial	Social Media	Search	
Citibank Chase PayPal Experian Bank of	Classmates Facebook	Ask Bing Google	
America	LinkedIn		
Computer HP Samsung Apple	Twitter	AOL	
News	Retail Sears eBay Amazon Best Buy	Yahoo!	
Fox News CBS Fox Media	Target		
NBC Universal NY Times	Craigslist		
ESPN	Wal-Mart		

The number of unique visitors for Amazon was more than that of Yahoo in 2010.

True		
False		
1 0150		
Omit		

Item 61 The Number of Unique Visitors for Websites in 2010

Websites								
Financial			Social Media			Search		
Citibank		PayPal	Classmates	Facebook		Ask	Bing	Google
Experian	Bank of America		LinkedIn					
Computer								
HP Sa	amsung	Apple	Twitter			AOL		
Dell			Retail					
			Sears	eBay	Amazon			
			Best Buy	1		Yahoo!		
News								
Fox News	CBS	Fox Media	Target					
NBC Universal NY Times			Craigslist					
	CNN		Wal-Mart	-				
ESPN	-		wai-wart					

Samsung is nested in the Financial category.

True			
False			
Omit			

The Summary of Difficulty Indexes (P)

	Visualization Task																		
			Retrieve Value (Derived Value)	Retrieve Value (Approximate Value		Find Extremum (Relative Value)		Find Extremum (Approximate Value)	Determine Range		Find Anomalies	Find Clusters	Find Correlations/ Trends	Make Comparisons (Absolute Value)	Make Comparisons (Relative Value)	Make Comparison (Derived Value)			Average
Line Chart	0.95				0.97				0.56				0.98	0.77					0.85
Bar Chart	0.88				0.98				0.54					0.4					0.70
Stacked Bar Chart	0.38	0.36			0.69									0.59	0.47				0.50
100% Stacked Bar Chart		0.49				0.9									0.54				0.64
Pie Chart		0.72				0.98									1				0.90
Histogram			0.84				0.94			0.16						0.86			0.70
Scatterplot	0.85				0.76				0.53		0.42	0.9	0.52	0.79					0.68
Area Chart	0.75				0.44				0.38				0.94						0.63
Stacked Area Chart	0.15	0.25			0.97								0.96	0.2	0.24				0.46
Bubble Chart	0.41				0.69				0.29		0.53	0.59	0.26	0.8					0.51
Choropleth Map				0.24				0.97									0.92		0.71
Treemap						0.68									0.42			0.92	0.67
Average	0.62	0.46	0.84	0.24	0.79	0.85	0.94	0.97	0.46	0.16	0.48	0.75	0.73	0.59	0.53	0.86	0.92	0.92	