Prof. Harrison's Group: Progress Report

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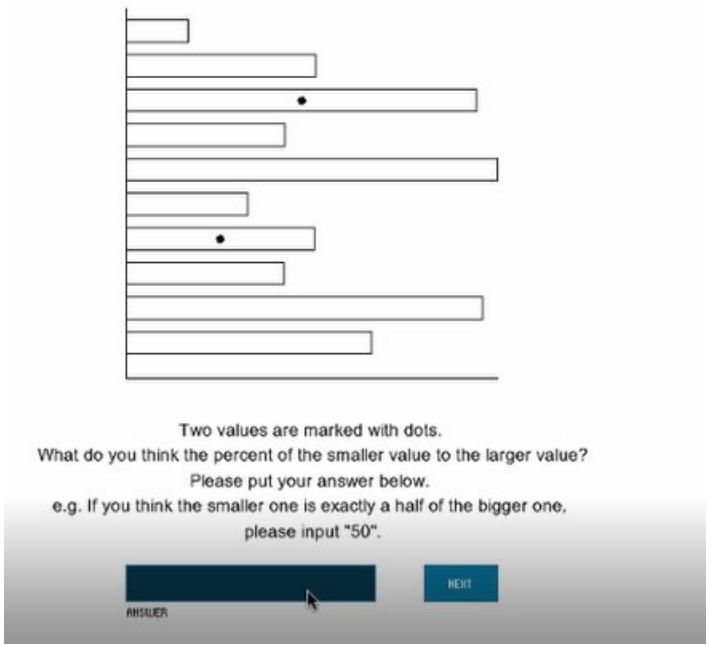
Background

- Emotion studies have been done many times in the past; these types of studies reveal the significance of facial expressions when studying human behavior.
    - Facial expressions were analyzed to find how engaged a student was; task performance was found to be correlated to the level of engagement.
    - Facial responses were examined to measure ad preferences. Companies could learn how to improve marketing strategies unobtrusively.
    - Using facial recognition software, scientists were able to distinguish between faked emotions and genuine emotions.

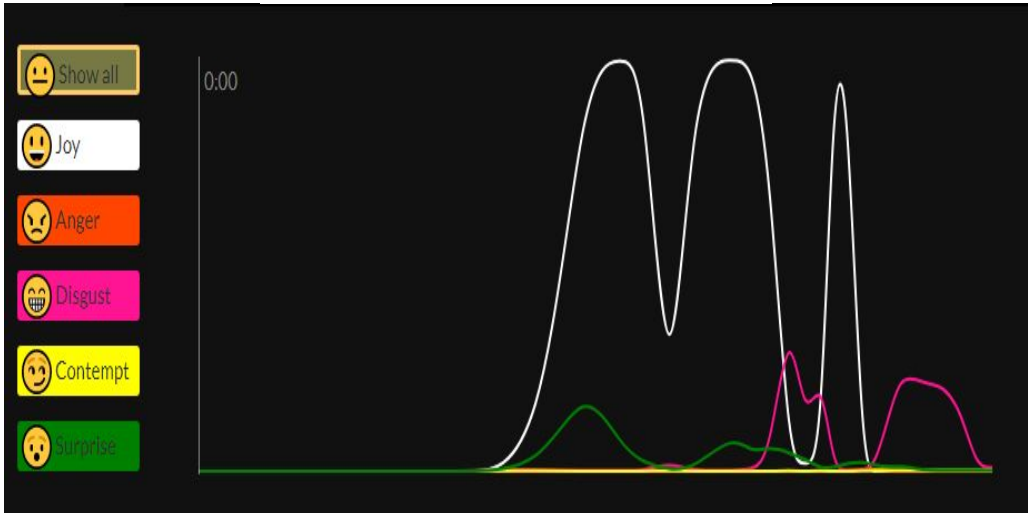
Our Project

- We are using Affectiva, an emotion-sensing software, to try to find a connection between how engaged a person is and how well they read data visualizations.
- A participant will be asked to analyze a bar chart, pie chart, and treemap chart while their facial expressions are being recorded and analyzed by Affectiva.
- The emotion stream will be merged/compared with the error chart to find correlations between the two.
- The results of the experiment may tell us about how well people can use data in stressful situations (e.g. the doctor’s office).



A problem presented to the participant.

:) Affectiva



An emotion chart created by Affectiva.

time	emotions	emotions	emotions	emotions	emotions	emotions	emotions	emotions	emotions	appearanc	appearanc	appearanc	appearanc	expressio	expressio	expressio	expressio	expressio	expressio	exp
3.85	0.001829	0.037029	0.427804	0.193122	0.001577	0.005038	0.222809	0	0.08106	Unknown	Yes	Unknown	Unknown	3.22E-08	6.637865	0.111386	0.017324	0.000431	0.000795	0.0
5.09	0.001474	0.050111	0.432135	0.20488	0.002022	0.005706	0.184492	0	0.100228	Unknown	Yes	Unknown	Unknown	1.04E-08	7.382669	0.071615	3.281779	0.000759	2.42E-07	0.0
5.35	0.00164	0.041254	0.427336	0.198709	0.00183	0.005307	0.198885	0	0.089289	Unknown	Yes	Unknown	Unknown	3.15E-09	6.288404	0.061636	1.646412	0.000965	5.47E-07	0.0
5.51	0.001691	0.036383	0.426673	0.196973	0.001838	0.005102	0.19961	0	0.086642	Unknown	Yes	Unknown	Unknown	2.76E-09	4.956582	0.077526	1.175959	0.001006	5.84E-07	0.0
5.61	0.001637	0.037229	0.426591	0.198896	0.001939	0.005174	0.192193	0	0.089735	Unknown	Yes	Unknown	Unknown	1.45E-09	4.703613	0.039904	1.692692	0.001211	5.87E-07	0.0
5.7	0.001733	0.040611	0.426551	0.195645	0.001668	0.005223	0.212132	0	0.08447	Unknown	Yes	Unknown	Unknown	1.79E-09	7.003974	0.051819	0.813073	0.0008	4.18E-07	0.0
5.79	0.001733	0.034535	0.426516	0.195644	0.001807	0.005013	0.202293	0	0.084547	Unknown	Yes	Unknown	Unknown	1.70E-09	4.580548	0.060859	0.81348	0.000681	3.74E-07	0.0
5.91	0.001742	0.035641	0.426484	0.195341	0.001761	0.005049	0.205582	0	0.084321	Unknown	Yes	Unknown	Unknown	2.14E-09	5.148765	0.05945	0.729216	0.000426	3.58E-07	0.0
6.03	0.001722	0.037079	0.426514	0.196036	0.001769	0.005116	0.204581	0	0.085318	Unknown	Yes	Unknown	Unknown	2.22E-09	5.521946	0.037893	0.919009	0.000688	3.18E-07	0.0
6.14	0.001719	0.033866	0.426556	0.196118	0.001853	0.004998	0.199133	0	0.086608	Unknown	Yes	Unknown	Unknown	1.61E-09	4.151411	0.058835	0.939091	0.001075	4.35E-07	0.
6.24	0.001706	0.03155	0.42668	0.196595	0.001951	0.004919	0.192927	0	0.087362	Unknown	Yes	Unknown	Unknown	2.13E-09	2.947377	0.041785	1.065586	0.001291	4.50E-07	0.0
6.32	0.001727	0.035429	0.426649	0.195918	0.0018	0.005051	0.202787	0	0.085937	Unknown	Yes	Unknown	Unknown	2.33E-09	4.895226	0.046336	0.882651	0.000747	3.33E-07	0.0
6.4	0.001768	0.034486	0.426954	0.194667	0.001749	0.004994	0.207202	0	0.084068	Unknown	Yes	Unknown	Unknown	2.19E-09	4.897439	0.040843	0.535856	0.001031	2.77E-07	0.0
6.48	0.001783	0.034711	0.426981	0.194189	0.001717	0.004996	0.209725	0	0.084059	Unknown	Yes	Unknown	Unknown	2.27E-09	5.140877	0.034177	0.406101	0.000728	2.32E-07	0.0
6.56	0.001779	0.035417	0.427016	0.194318	0.001707	0.005024	0.210386	0	0.084696	Unknown	Yes	Unknown	Unknown	2.21E-09	5.404207	0.034882	0.441972	0.001268	2.14E-07	0.0
6.63	0.001781	0.034249	0.427222	0.194291	0.001733	0.004984	0.208639	0	0.084797	Unknown	Yes	Unknown	Unknown	2.63E-09	4.926477	0.038513	0.433907	0.000736	1.98E-07	0.0
6.74	0.001802	0.03635	0.427446	0.193677	0.001646	0.005045	0.215762	0	0.083904	Unknown	Yes	Unknown	Unknown	4.19E-09	6.030675	0.04308	0.260981	0.001019	2.41E-07	0.0
6.81	0.001809	0.036078	0.427493	0.19346	0.001638	0.00503	0.216552	0	0.083611	Unknown	Yes	Unknown	Unknown	4.85E-09	5.996782	0.049167	0.196296	0.000714	2.28E-07	0.0
6.89	0.001815	0.041737	0.427641	0.193305	0.001514	0.005212	0.227318	0	0.083334	Unknown	Yes	18 - 24	East Asian	6.84E-09	8.246468	0.052571	0.149665	0.000736	2.77E-07	0.0
6.98	0.001813	0.056031	0.428034	0.19339	0.001307	0.005606	0.248673	0	0.083423	Unknown	Yes	18 - 24	East Asian	5.95E-09	12.67276	0.072181	0.17287	0.000479	3.01E-07	0.0
7.17	0.001824	0.085789	0.428304	0.193081	0.00104	0.006222	0.285951	0	0.082701	Unknown	Yes	18 - 24	East Asian	1.13E-08	19.21588	0.116743	0.0704	0.001138	3.37E-07	0.0

A portion of emotion data for one participant.

R Programming

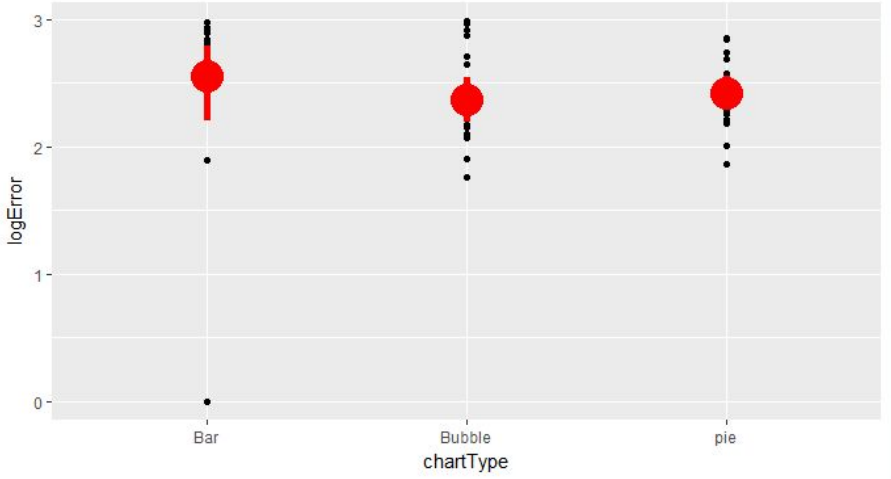
- R is an open source programming language that is used for data visualization and analysis.
- It is an efficient way of presenting data in different forms, i.e; linear and nonlinear modeling, statistical tests, etc.
- We learned how to use R for data transformation, data visualization, and how to create and use R Markdown files.
- We focused mainly on ggplot and dplyr in the tidyverse package.

Data Analysis Using R Programming

- Using R we can calculate which of the targets are bigger or smaller:
  - data3p$smaller<- ifelse(data3p$targetA < data3p$targetB, data3p$targetA, data3p$targetB)
- We can also use it to calculate error and the accurate value of the smaller piece over the larger piece for every participant:
  - Data3p$actualDifference <- data3p$smaller / data3p$larger
  - data_3_participants$error <- data_3_participants$actualDifference - data_3_participants$input
- R will also be helpful when constructing error charts, compiling the emotion data, and comparing the two data sets to find correlation.

chartType	targetA	targetB	input	time	smaller	larger	actualDifference	error	logError
Bubble	20	83	0.18	36.92	20	83	0.24096386	0.060963855	2.426906
Bar	57	70	0.80	41.63	57	70	0.81428571	0.014285714	2.843881
pie	50	88	0.50	48.43	50	88	0.56818182	0.068181818	2.371969
Bar	29	7	0.25	53.22	7	29	0.24137931	-0.008620690	2.903785
pie	31	39	0.70	60.04	31	39	0.79487179	0.094871795	2.185266
Bubble	42	15	0.50	64.01	15	42	0.35714286	-0.142857143	1.900464
pie	20	74	0.30	71.01	20	74	0.27027027	-0.029729730	2.692178
Bubble	71	64	0.90	75.37	64	71	0.90140845	0.001408451	2.983835
Bar	5	42	0.15	98.32	5	42	0.11904762	-0.030952381	2.680823
Bubble	6	17	0.45	107.47	6	17	0.35294118	-0.097058824	2.170986
Bar	15	53	0.30	113.21	15	53	0.28301887	-0.016981132	2.816229
pie	93	73	0.70	120.34	73	93	0.78494624	0.084946237	2.251908
Bar	89	49	0.60	126.78	49	89	0.55056180	-0.049438202	2.519212
pie	42	90	0.48	136.67	42	90	0.46666667	-0.013333333	2.853779
Bubble	99	55	0.50	142.72	55	99	0.55555556	0.055555556	2.469485
pie	66	7	0.18	152.25	7	66	0.10606061	-0.073939394	2.329599
Bubble	82	59	0.55	161.21	59	82	0.71951220	0.169512195	1.763601
Bar	94	45	0.55	166.31	45	94	0.47872340	-0.071276596	2.349040
Bubble	16	81	0.10	12.91	16	81	0.19753086	0.097530864	2.167923
pie	53	3	0.10	24.88	3	53	0.05660377	-0.043396226	2.570068
Bar	4	9	0.30	35.33	4	9	0.44444444	0.144444444	1.891940

A sample of data collected for the chart experiment.



An example of an error chart created in R.

Future Plans

- Gather more data by testing more participants.
- Create error charts to show the error participants made when analyzing bar, pie, and treemap charts.
- Figure out how to compile the emotion stream data into pieces we can use alongside the error data.
- Compare the amount of error the participant made to the emotion data we compiled from Affectiva.

References

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