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Patterns in Color Perception

Madeline Henson
Ohio Wesleyan University

Taimur Iftikhar
Ohio Wesleyan University

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Synesthesia In Color Perception

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By Madeline Henson and Taimur Iftikhar

What is Synesthesia?

Synesthesia can be defined as *“a condition that happens when a sense triggers another sense, at the same time”*

-vocabulary.com



How many colors does this “A” have?



Introduction

- Our focus was towards Grapheme Synesthesia.
- Specific kind of Synesthesia, where printed characters produced colors associated with them.
- The database we used had 4 kinds of languages, Hiragana, Katakana, Kanji and the Latin Alphabet.
- Database was put together by Daisuke Hamada, Hiroki Yamamoto and Jun Suiki

Database

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
1	synesthesia	grapheme	h	v	c	L	a	b	R	G	B	x	y	Y	satisfy														
2	SH	A	SR	4	14	68.428137	59.2707	52.79616	0.956087	0.080689	0	0.54147	0.351	11.566685	0														
3	SH	SPB	4	12	32.351002	43.351593	-78.898955	0	0.129932	0.606025	0.150916	0.087284	2.17252	0															
4	SH	C	5Y	9	10	105.599439	-23.8023462	72.568786	0.090687	0.799036	0.223775	0.457833	34.557475	15.001555	0														
5	SH	B	7.5SR	7	12	76.072443	78.899147	0.922056	0.403084	0	0.505814	0.41855	0	0															
6	SH	G	7.5G	5	8	64.043403	-58.701319	25.418061	0.246029	0.536422	0.206976	0.254458	0.453869	9.856527	0														
7	SH	F	5SR	7	6	80.289621	25.227078	-61.711102	0.670008	0.518999	1	0.224081	0.19136	17.158753	0														
8	SH	L	2.5GY	4	4	38.127169	2.780765	42.454135	0.41034	0.230018	0	0.460337	0.45286	3.047848	0														
9	SH	H	2.5Y	8.5	6	98.234927	-0.624974	42.255389	1	0.6833	0.439814	0.383126	0.392032	28.651279	0														
10	SH	I	10P	8	6	112.404764	-6.775996	-8.817371	1	0.838256	0.966903	0.288582	0.305242	40.690281	0														
11	SH	J	7.5SR	3	2	46.076769	5.641538	-4.353749	0.436664	0.290208	0.258488	0.309143	0.296006	4.597636	0														
12	SH	K	2.5G	6	10	71.830917	-46.877389	66.211976	0.513614	0.574229	0	0.352714	0.534532	13.022355	0														
13	SH	L	7.5Y	9	8	108.995671	-30.393748	79.580052	1	0.843905	0.166506	0.387785	0.472031	37.534636	0														
14	SH	M	10RP	8	6	96.169044	12.66079	12.069276	1	0.634533	0.652486	0.35005	0.329005	27.124788	0														
15	SH	N	5Y	9	6	108.922529	28.553212	69.097094	1	0.839452	0.301615	0.378003	0.453742	37.468783	0														
16	SH	O	N	9	0	111.041203	-16.703069	13.611012	0.986378	0.843662	0.786456	0.311451	0.348397	39.407699	0														
17	SH	P	5YR	7	12	90.75628	10.838665	62.758993	1	0.583488	0.161207	0.44002	0.418278	23.384473	0														
18	SH	Q	5YR	6	1	91.49312	-5.499951	1.734442	0.820375	0.657506	0.675859	0.305604	0.322881	23.872027	0														
19	SH	R	5Y	9	10	102.582731	-17.444435	76.495116	1	0.757146	0.110575	0.406587	0.459961	32.04879	0														
20	SH	S	5YR	4	12	55.514978	26.790607	-85.982837	0	0.360535	0.891885	0.156749	0.124236	7.029725	0														
21	SH	T	5YR	4	12	40.422932	51.189672	-94.203256	0	0.176836	0.78599	0.147883	0.08499	3.452345	0														
22	SH	U	5Y	9	4	110.684213	-26.259026	47.917174	1	0.853782	0.517625	0.351233	0.41508	39.076421	0														
23	SH	V	5Y	6	8	95.864761	-17.547819	86.439437	0.930786	0.7014	0	0.422682	0.481548	26.90464	0														
24	SH	X	2.5Y	3	2	34.015274	15.675204	15.919077	0.403184	0.165237	0	0.244498	0.350559	2.465246	0														
25	SH	Y	N	6	0	96.802267	-5.535844	4.347507	0.879416	0.699159	0.710765	0.310393	0.27586154	27.586154	0														
26	SH	Z	5Y	6	1	99.512918	-4.945172	48.658535	1	0.704283	0.398116	0.386579	0.40604	29.623676	0														
27	SH	AA	7.5PB	3	10	50.381905	17.992337	-52.185576	0.355783	0.316897	0.621602	0.202022	0.171502	5.622072	0														
28	SH	AB	0	N	9	0	108.441895	-10.867752	-6.224143	0.936567	0.814671	0.90384	0.287217	37.037967	0														
29	SH	AC	1	N	9	0	107.004866	-10.554741	8.034464	0.966198	0.795354	0.786544	0.310172	35.796607	0														
30	SH	AD	2	10RP	8	6	95.872717	21.559734	-16.811118	0.972805	0.619033	0.307355	0.274776	26.910381	0														
31	SH	AE	3	7.5PB	6	10	75.865412	-7.766028	-69.03429	0	0.582275	1	0.170305	0.184229	14.900587	0													
32	SH	AF	4	5Y	9	8	108.271615	-27.963014	72.080613	1	0.831898	0.261715	0.382953	0.458485	36.886132	0													
33	SH	AG	5	SR	4	14	66.313649	55.680844	54.893602	0.9174	0.122834	0	0.544099	0.358159	10.1719212	0													
34	SH	AH	6	2.5YR	6	14	87.488064	16.800174	73.086338	1	0.355798	0	0.468484	0.427417	21.301587	0													
35	SH	AI	7	5YR	4	12	54.337709	-25.905029	-84.026586	0	0.3533	0.866163	0.156028	6.68519	0														
36	SH	AJ	8	7.5G	5	8	54.586029	-56.274139	38.739367	0.216852	0.455543	0	0.278645	0.524706	6.754159	0													
37	SH	AK	9	2.5Y	4	2	40.204117	16.176636	10.422542	0.458617	0.209697	0.008117	0.392766	3.412335	0														
38	AH	A	7.5R	5	12	69.904836	82.860086	47.542473	1	0	0.095946	0.567453	0.315608	12.184287	0														
39	AH	B	5YR	7	12	83.474989	43.975569	78.455858	1	0.481909	0	0.525131	0.399378	18.9186	0														
40	AH	C	5Y	8.5	10	96.58429	13.040273	86.366888	1	0.686396	0	0.469189	0.441058	27.335267	0														
41	AH	D	10PB	4	8	56.047368	20.004467	-51.259749	0.377547	0.373918	0.682841	0.21434	0.181173	7.187894	0														
42	AH	E	5YR	7	8	84.009001	-19.768844	-54.168	0	0.683913	0.997746	0.18778	0.220247	19.22371	0														
43	AH	F	7.5GY	7	10	78.070984	-43.743898	51.786892	0.485904	0.649877	0.0963	0.336516	0.48313	15.999792	0														
44	AH	G	2.5Y	7	10	84.093354	25.856272	78.673369	0.92207	0.548181	0	0.495232	0.423938	19.273608	0														
45	AH	H	7.5GY	7	10	86.764915	-49.879605	60.231917	0.539406	0.733558	0.081104	0.338384	0.493615	20.858443	0														
46	AH	I	5Y	9	6	107.248295	-0.72785	46.957911	1	0.819554	0.499762	0.385168	0.39424	35.982393	0														
47	AH	J	10PB	4	8	66.194123	31.98596	-51.304099	0.561803	0.418484	0.788534	0.241601	0.186052	10.72584	0														
48	AH	K	5G	6	10	62.232087	-59.203009	77.644136	0	0.537795	0	0.275803	0.501715	9.202772	0														
49	AH	L	5Y	8	10	104.616908	-2.479209	77.578505	1	0.796533	0.127394	0.428139	0.442729	33.726546	0														
50	AH	M	5G	6	10	65.469652	-57.748583	23.167362	1	0.565008	0.244644	0.253048	0.442192	10.392855	0														
51	AH	N	2.5G	5	8	54.458716	-41.1636	25.73107	0.22779	0.453272	0.049746	0.286336	0.451821	6.72282	0														
52	AH	O	N	8	0	116.737906	-6.340542	9.391594	0.99351	0.926523	0.888051	0.317046	0.334169	44.950257	0														
53	AH	P	7.5RP	8	6	98.738578	27.541606	-17.521717	1	0.654921	0.899004	0.325943	0.268773	29.031884	0														
54	AH	Q	7.5P	7	8	69.637104	67.407854	-23.340003	0.848291	0.276258	0.641748	0.363742	0.224716	12.070721	0														
55	AH	R	5R	6	14	70.774578	66.822782	30.947732	0.929026	0.262938	0.281039	0.502642	0.312699	12.558125	0														
56	AH	S	7.5R	5	12	70.326657	70.729102	70.946579	0.983636	0.216047	0	0.585697	0.354215	12.364657	0														
57	AH	T	7.5B	7	6	73.021885	-19.931714	-33.439493	0.278471	0.585061	0.737067</																		

Our Goals:

Goal 1: Is there a link between the number of strokes it takes to draw characters

Goal 2: Different languages have different kinds of colours associated with them for synesthesia patients.

Goal 3: Different languages lead to different number of colours seen

Goal 1: Complexity relates to colors

- As number of strokes point towards how complex it is to draw characters.
- We did a lot of regression analysis to see the correlation between the number of strokes and the amount of colors patients saw.
- These graphs show a strong correlation between the number of strokes and the amount of colours seen by Synesthesia patients.

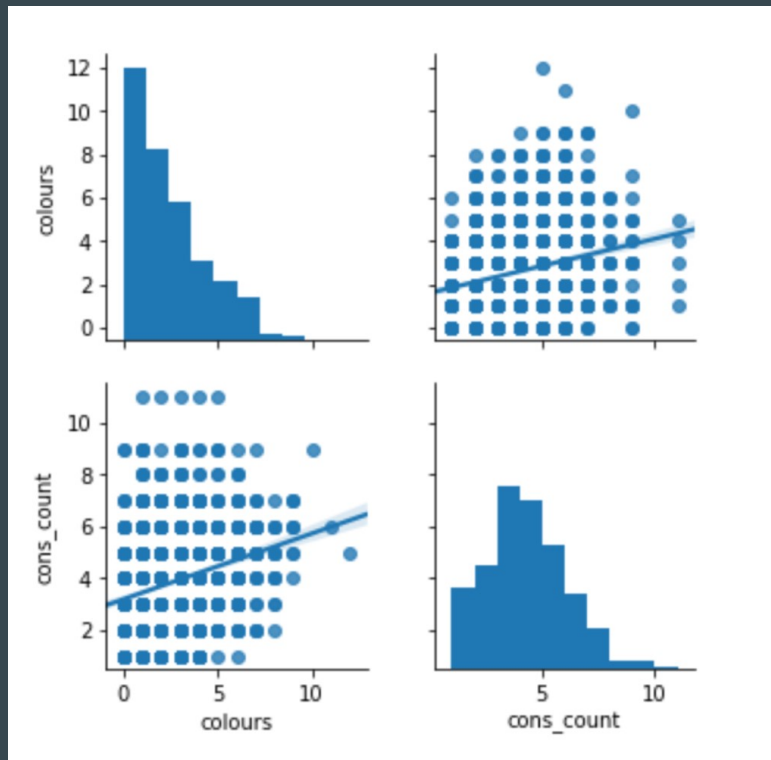
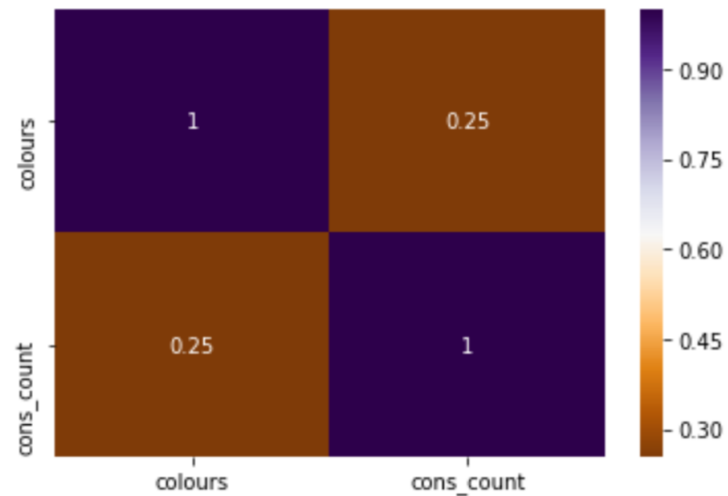
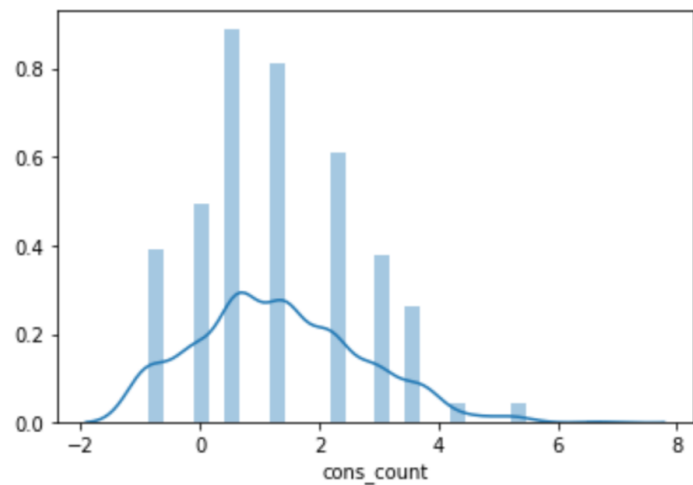


Fig. 4: Predicted plot of constituent and colors



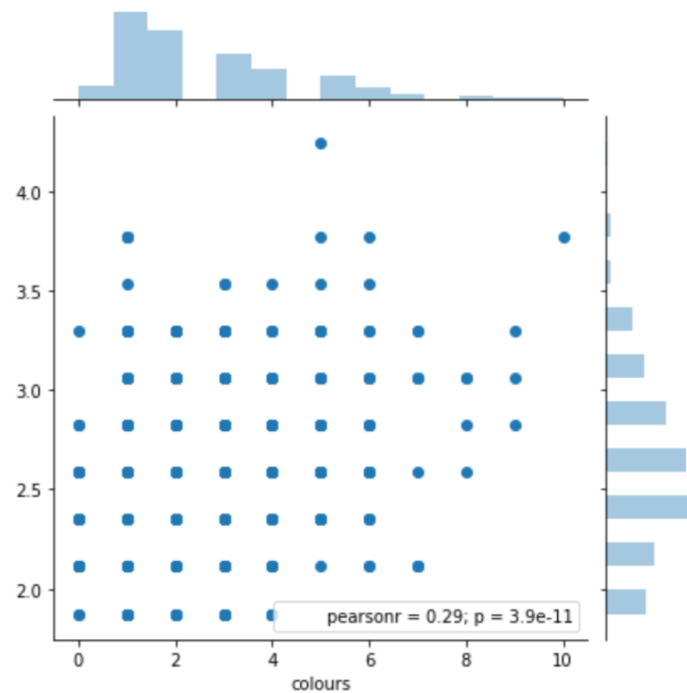
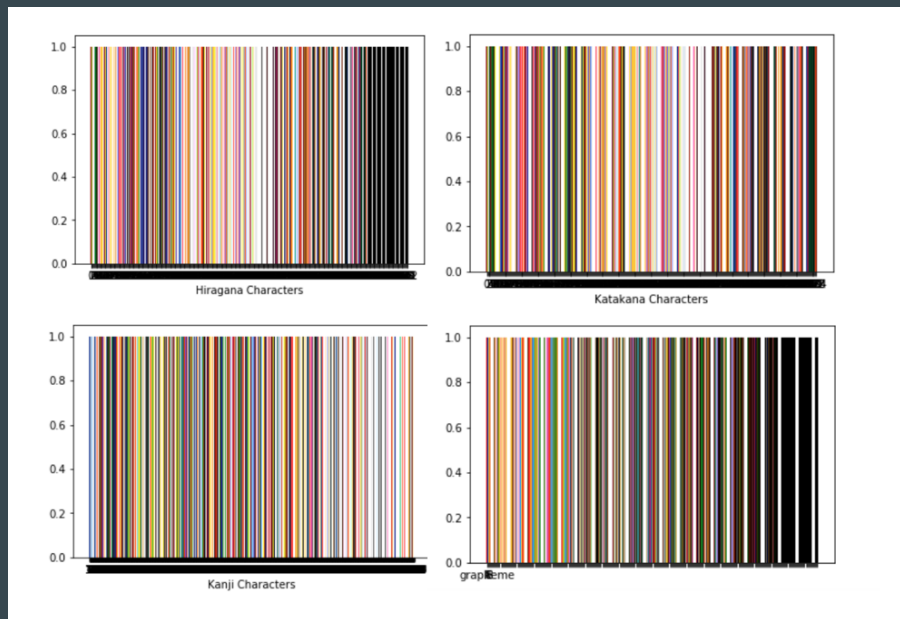


Fig. 4. Predicted plot of constituent and colors

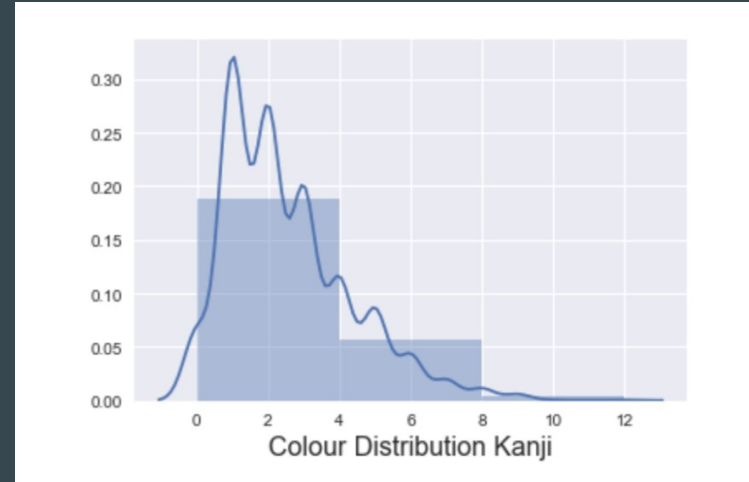
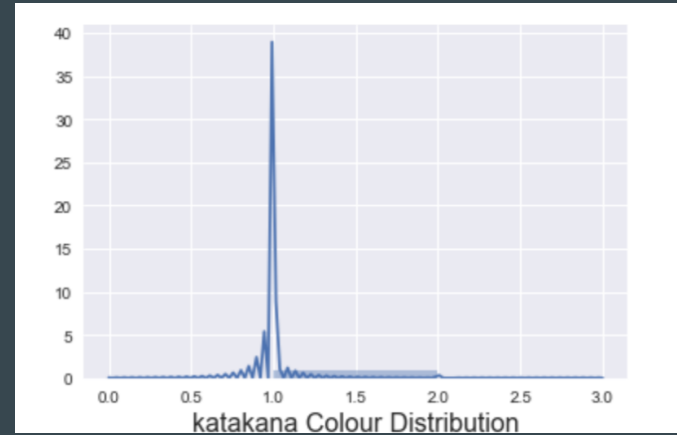
Goal 2:

- We also looked at different languages and all the characters that patients saw of each language.
- For each language's characters, patients saw different types of colours and that is what we were able to produce.
- These graphs show that for different languages patients saw different colors.



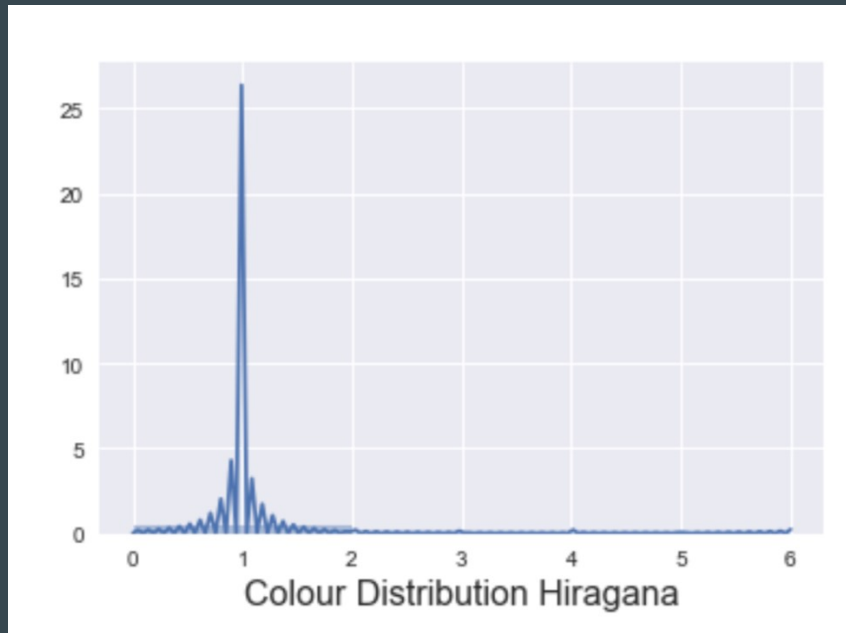
Goal 3

- As we had different languages, we also wanted to see if the distribution of the number of colors seen for different languages was different.
- We expected that since drawing each character of different languages is different, we will have different number of colors seen.
- The kanji language as had the largest distribution of colors seen.
- Whereas Hiragana and Katakana had a more similar distribution.



Goal 3 continued...

- This shows that languages are inherently quite different not just in terms of drawing characters but also the amount and kind of senses they stimulate.



Conclusion

- The presence of synesthesia proves that there is no incorrect way to experience the world.
- Vibrancy of colors in languages is a lot different with one language's characters seeming more brighter than the other.
- Number of colors seen is also different for each language.
- Complexity of characters also relates to the amount of colors a person sees.