

Analysing QDA data with SensoMineR

Assessing panel performances.

Let's first have a look at one panelist

- To study his performance when tasting products for a screening perspective
 - Discrimination ability
 - Repeatable





Let's first have a look at one panelist (6)

	Session	Product	Astringency	Crunchy	Melting	Sticky
I031	1	choc5	1	7	9	1
I032	1	choc3	0	8	3	8
I033	1	choc6	0	5	7	9
I034	1	choc1	5	7	6	9
I035	1	choc4	4	7	4	9
I036	1	choc2	6	10	8	7
I205	2	choc3	2	7	9	1
I206	2	choc5	6	8	8	4
I207	2	choc1	7	6	9	2
I208	2	choc6	0	6	5	8
I209	2	choc4	5	8	6	3
I210	2	choc2	4	9	5	6



The Analysis of Variance model

- Descriptor \sim Product
- Descriptor \sim Product + Session



AoV model: Sticky \sim Product + Session

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$Ftest
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	Sum Sq	Df	CM	F value	Pr(>F)
Product	40.417	5	8.0833	0.9528	0.5205
Session	30.083	1	30.0833	3.5462	0.1184
Residuals	42.417	5	8.4833		



AoV model: Crunchy ~ Product + Session

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$Ftest
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	Sum Sq	Df	CM	F value	Pr(>F)
Product	17.667	5	3.5333	5.8889	0.03703
Session	0.000	1	0.0000	2.705e-30	1.00000
Residuals	3.000	5	0.6000		



Let's do that for all panelists and all descriptors!

P-value of the F-test (by panelist)

	CocoaA	MikA	CocoaF	MikF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency	Crunchy	Melting	Sticky	Granular
1	0.09507	0.4758	0.0107	0.006469	0.1293	0.06586	0.03133	0.2113	0.07121	0.1679	0.4302	0.0718	0.4704	0.8898
2	0.8445	0.5651	0.1589	0.008571	0.5	0.5	0.09539	0.5	0.1499	NaN	0.001512	0.1837	0.2071	0.3451
3	0.02174	0.03816	0.06485	0.01252	0.2804	0.5369	0.004129	0.136	0.01804	0.008451	0.07108	0.7921	0.6942	0.5818
4	0.08868	0.1362	0.8255	0.0627	0.2083	0.1096	0.4607	0.1366	0.3091	0.1519	0.8554	0.001782	0.1049	0.6385
5	0.1394	0.7742	0.07987	0.01378	0.05932	0.2168	0.00591	0.343	0.04237	0.2256	0.5462	0.8233	0.1604	0.1619
6	0.9192	0.5698	0.1528	0.2604	0.5346	0.649	0.5207	0.1478	0.6234	0.0747	0.03703	0.7523	0.5205	0.05563
7	0.8979	0.8787	0.5641	0.5958	0.486	0.6847	0.04997	0.04683	0.7942	0.372	0.05046	0.07778	0.2823	0.2491
8	0.3893	0.233	0.01888	0.005569	0.636	0.1973	0.2437	0.1805	0.2062	0.3179	0.06808	0.01834	0.09351	0.04027
9	0.01371	0.007978	0.007354	0.03066	0.02243	0.3421	0.002467	0.05423	0.0814	0.2758	0.06437	0.3062	0.2529	0.2733
10	0.7925	0.4139	0.06924	9.363e-05	0.06836	0.1356	0.08661	0.5	0.04837	0.1792	0.01613	0.7433	0.2454	0.01371
11	0.5	0.1626	0.346	0.01209	0.006424	0.04141	0.0329	0.02609	0.1138	0.9444	0.1175	0.02681	0.1966	0.1058
12	0.3834	0.2379	0.3272	0.004316	0.2468	0.0364	0.07476	0.5362	0.008107	0.5	0.1208	0.6324	0.3155	0.5
13	0.03466	0.04911	0.004447	0.002417	0.3693	0.03366	0.3778	0.5949	0.7928	0.2871	0.3512	0.02407	0.3276	0.8504
14	0.2421	0.3127	0.06079	0.1008	0.02462	0.8313	0.2621	0.38	0.1032	0.178	0.09687	0.1149	0.1152	0.06197
15	0.08239	0.7887	8.322e-05	0.06467	0.005003	0.1531	0.09109	0.4138	0.01569	0.06375	0.04688	0.2444	0.2621	0.6868
16	0.5937	0.1696	0.02318	0.02378	0.002031	0.1627	0.007761	0.03259	0.001006	0.005257	0.04444	0.001494	0.3681	0.7675
17	0.5396	0.5616	0.052	0.01897	0.003975	0.007966	0.02106	0.1856	0.133	0.3669	0.01115	0.009665	0.4488	0.06846
18	0.5908	0.3153	0.03584	0.001577	0.2051	0.5	0.02525	0.02227	0.009818	0.1831	0.2153	0.4339	0.1245	0.07065
19	0.387	0.2223	0.2333	0.02482	0.1888	0.2655	0.1383	0.38	0.1165	0.8851	0.01858	0.05532	0.6828	0.6367
20	0.5744	0.8369	0.08901	0.01383	0.2034	0.6907	0.1938	0.2432	0.02633	0.09246	0.08337	0.3675	0.5275	0.09614
21	0.7784	0.002755	0.8146	0.008363	0.0004397	NaN	0.2829	0.0009066	0.351	0.02103	0.6602	0.04531	0.7929	0.2504
22	0.8393	0.1081	0.141	0.01865	0.002955	NaN	0.3761	0.05562	0.007895	0.5	0.00488	0.0568	0.4689	0.6231
23	0.9898	0.9509	0.002734	0.004931	0.013	0.1266	0.1512	0.02392	0.03349	0.2075	0.0654	0.2406	0.9228	0.01406
24	0.09554	0.03505	0.01537	0.07809	0.02243	0.032	0.02366	0.04684	0.0597	0.323	0.02073	0.3701	0.09144	0.7754
25	0.7433	0.9711	0.0901	0.4176	0.5	0.5	0.375	0.5	0.01056	0.1913	0.008016	6.928e-73	0.8964	0.5
26	0.4102	0.7869	0.1777	0.3516	0.00645	0.1062	0.1753	0.067	0.1431	0.5529	0.04542	0.6463	0.5565	0.08797
27	0.4793	0.3505	0.2026	0.187	0.3749	0.5	0.9074	0.4687	0.1629	0.4039	0.1538	0.4205	0.8687	0.2621
28	0.0488	0.003159	0.01318	0.001512	0.01897	0.179	0.0001605	0.6825	0.001442	0.05153	0.08607	0.03988	0.04548	0.7573
29	0.9998	0.2294	0.1184	0.2351	0.1314	0.09335	0.1898	0.4726	0.04006	0.4771	0.295	0.02361	0.563	0.1451

P-value of the F-test (by panelist)

	CocoaA	MilkA	CocoaF	MilkF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency
1	0.09507	0.4758	0.0107	0.006469	0.1293	0.06586	0.03133	0.2113	0.07121	0.1679
2	0.8445	0.5651	0.1589	0.008571	0.5	0.5	0.09539	0.5	0.1499	NaN
3	0.02174	0.03816	0.06485	0.01252	0.2804	0.5369	0.004129	0.136	0.01804	0.008451
4	0.08868	0.1362	0.8255	0.0627	0.2083	0.1096	0.4607	0.1366	0.3091	0.1519
5	0.1394	0.7742	0.07987	0.01378	0.05932	0.2168	0.00591	0.343	0.04237	0.2256
6	0.9192	0.5698	0.1528	0.2604	0.5346	0.649	0.5207	0.1478	0.6234	0.0747
7	0.8979	0.8787	0.5641	0.5958	0.486	0.6847	0.04997	0.04683	0.7942	0.372
8	0.3893	0.233	0.01888	0.005569	0.636	0.1973	0.2437	0.1805	0.2062	0.3179
9	0.01371	0.007978	0.007354	0.03066	0.02243	0.3421	0.002467	0.05423	0.0814	0.2758
10	0.7925	0.4139	0.06924	9.363e-05	0.06836	0.1356	0.08661	0.5	0.04837	0.1792
11	0.5	0.1626	0.346	0.01209	0.006424	0.04141	0.0329	0.02609	0.1138	0.9444
12	0.3834	0.2379	0.3272	0.004316	0.2468	0.0364	0.07476	0.5362	0.008107	0.5
13	0.03466	0.04911	0.004447	0.002417	0.3693	0.03366	0.3778	0.5949	0.7928	0.2871
14	0.2421	0.3127	0.06079	0.1008	0.02462	0.8313	0.2621	0.38	0.1032	0.178
15	0.08239	0.7887	8.322e-05	0.06467	0.005003	0.1531	0.09109	0.4138	0.01569	0.06375



Let's « magic » sort this data table

P-value of the F-test (by panelist)

	MIKF	Crunchy	Bitterness	CocoaF	Sweetness	Melting	Caramel	Vanilla	Acidity	Astringency	Granular	MiKA	Sticky	CocoaA	median
16	0.02378	0.04444	0.001006	0.02318	0.007761	0.001494	0.002031	0.1627	0.03259	0.005257	0.7675	0.1696	0.3681	0.5937	0.02818
28	0.001512	0.08607	0.001442	0.01318	0.0001605	0.03988	0.01897	0.179	0.6825	0.05153	0.7573	0.003159	0.04548	0.0488	0.04268
24	0.07809	0.02073	0.0597	0.01537	0.02366	0.3701	0.02243	0.032	0.04684	0.323	0.7754	0.03505	0.09144	0.09554	0.05327
9	0.03066	0.06437	0.0814	0.007354	0.002467	0.3062	0.02243	0.3421	0.05423	0.2758	0.2733	0.007978	0.2529	0.01371	0.0593
17	0.01897	0.01115	0.133	0.052	0.02106	0.009665	0.003975	0.007966	0.1856	0.3669	0.06846	0.5616	0.4488	0.5396	0.06023
3	0.01252	0.07108	0.01804	0.06485	0.004129	0.7921	0.2804	0.5369	0.136	0.008451	0.5818	0.03816	0.6942	0.02174	0.06797
15	0.06467	0.04688	0.01569	8.322e-05	0.09109	0.2444	0.005003	0.1531	0.4138	0.06375	0.6868	0.7887	0.2621	0.08239	0.08674
23	0.004931	0.0654	0.03349	0.002734	0.1512	0.2406	0.013	0.1266	0.02392	0.2075	0.01406	0.9509	0.9228	0.9898	0.09599
22	0.01865	0.00488	0.007895	0.141	0.3761	0.0568	0.002955	NaN	0.05562	0.5	0.6231	0.1081	0.4689	0.8393	0.1081
11	0.01209	0.1175	0.1138	0.346	0.0329	0.02681	0.006424	0.04141	0.02609	0.9444	0.1058	0.1626	0.1966	0.5	0.1098
10	9.363e-05	0.01613	0.04837	0.06924	0.08661	0.7433	0.06836	0.1356	0.5	0.1792	0.01371	0.4139	0.2454	0.7925	0.1111
1	0.006469	0.4302	0.07121	0.0107	0.03133	0.0718	0.1293	0.06586	0.2113	0.1679	0.8898	0.4758	0.4704	0.09507	0.1122
14	0.1008	0.09687	0.1032	0.06079	0.2621	0.1149	0.02462	0.8313	0.38	0.178	0.06197	0.3127	0.1152	0.2421	0.115
4	0.0627	0.8554	0.3091	0.8255	0.4607	0.001782	0.2083	0.1096	0.1366	0.1519	0.6385	0.1362	0.1049	0.08868	0.1443
18	0.001577	0.2153	0.009818	0.03584	0.02525	0.4339	0.2051	0.5	0.02227	0.1831	0.07065	0.3153	0.1245	0.5908	0.1538
5	0.01378	0.5462	0.04237	0.07987	0.00591	0.8233	0.05932	0.2168	0.343	0.2256	0.1619	0.7742	0.1604	0.1394	0.1611
26	0.3516	0.04542	0.1431	0.1777	0.1753	0.6463	0.00845	0.1062	0.067	0.5529	0.08797	0.7869	0.5565	0.4102	0.1765
8	0.005569	0.06808	0.2062	0.01888	0.2437	0.01834	0.636	0.1973	0.1805	0.3179	0.04027	0.233	0.09351	0.3893	0.1889
20	0.01383	0.08337	0.02633	0.08901	0.1938	0.3675	0.2034	0.6907	0.2432	0.09246	0.09614	0.8369	0.5275	0.5744	0.1986
2	0.008571	0.001512	0.1499	0.1589	0.09539	0.1837	0.5	0.5	0.5	NaN	0.3451	0.5651	0.2071	0.8445	0.2071
29	0.2351	0.295	0.04006	0.1184	0.1898	0.02361	0.1314	0.09335	0.4726	0.4771	0.1451	0.2294	0.563	0.9998	0.2096
19	0.02482	0.01858	0.1165	0.2333	0.1383	0.05532	0.1888	0.2655	0.38	0.8851	0.6367	0.2223	0.6828	0.387	0.2278
21	0.008363	0.6602	0.351	0.8146	0.2829	0.04531	0.0004397	NaN	0.0009066	0.02103	0.2504	0.002755	0.7929	0.7784	0.2504
12	0.004316	0.1208	0.008107	0.3272	0.07476	0.6324	0.2468	0.0364	0.5362	0.5	0.5	0.2379	0.3155	0.3834	0.2812
13	0.002417	0.3512	0.7928	0.004447	0.3778	0.02407	0.3693	0.03366	0.5949	0.2871	0.8504	0.04911	0.3276	0.03466	0.3073
27	0.187	0.1538	0.1629	0.2026	0.9074	0.4205	0.3749	0.5	0.4687	0.4039	0.2621	0.3505	0.8687	0.4793	0.3894
7	0.5958	0.05046	0.7942	0.5641	0.04997	0.07778	0.486	0.6847	0.04683	0.372	0.2491	0.8787	0.2823	0.8979	0.429
25	0.4176	0.008016	0.01056	0.0901	0.375	8.928e-73	0.5	0.5	0.5	0.1913	0.5	0.9711	0.8964	0.7433	0.4588
6	0.2604	0.03703	0.6234	0.1528	0.5207	0.7523	0.5346	0.649	0.1478	0.0747	0.05563	0.5698	0.5205	0.9192	0.5206
median	0.01865	0.06808	0.07121	0.07987	0.09539	0.1149	0.1293	0.179	0.1856	0.2166	0.2621	0.3127	0.3276	0.4793	0.1538

P-value of the F-test (by panelist)

	MilkF	Crunchy	Bitterness	CocoaF	Sweetness	Melting	Caramel	Vanilla	Acidity	Astringency
16	0.02378	0.04444	0.001006	0.02318	0.007761	0.001494	0.002031	0.1627	0.03259	0.005257
28	0.001512	0.08607	0.001442	0.01318	0.0001605	0.03988	0.01897	0.179	0.6825	0.05153
24	0.07809	0.02073	0.0597	0.01537	0.02366	0.3701	0.02243	0.032	0.04684	0.323
9	0.03066	0.06437	0.0814	0.007354	0.002467	0.3062	0.02243	0.3421	0.05423	0.2758
17	0.01897	0.01115	0.133	0.052	0.02106	0.009665	0.003975	0.007966	0.1856	0.3669
3	0.01252	0.07108	0.01804	0.06485	0.004129	0.7921	0.2804	0.5369	0.136	0.008451
15	0.06467	0.04688	0.01569	8.322e-05	0.09109	0.2444	0.005003	0.1531	0.4138	0.06375
23	0.004931	0.0654	0.03349	0.002734	0.1512	0.2406	0.013	0.1266	0.02392	0.2075
22	0.01865	0.00488	0.007895	0.141	0.3761	0.0568	0.002955	NaN	0.05562	0.5
11	0.01209	0.1175	0.1138	0.346	0.0329	0.02681	0.006424	0.04141	0.02609	0.9444
10	9.363e-05	0.01613	0.04837	0.06924	0.08661	0.7433	0.06836	0.1356	0.5	0.1792
1	0.006469	0.4302	0.07121	0.0107	0.03133	0.0718	0.1293	0.06586	0.2113	0.1679
14	0.1008	0.09687	0.1032	0.06079	0.2621	0.1149	0.02462	0.8313	0.38	0.178
4	0.0627	0.8554	0.3091	0.8255	0.4607	0.001782	0.2083	0.1096	0.1366	0.1519
18	0.001577	0.2153	0.009818	0.03584	0.02525	0.4339	0.2051	0.5	0.02227	0.1831

P-value of the F-test (by panelist)

	Sweetness	Melting	Caramel	Vanilla	Acidity	Astringency	Granular	MilKA	Sticky	CocoaA
4	0.4607	0.001782	0.2083	0.1096	0.1366	0.1519	0.6385	0.1362	0.1049	0.08868
18	0.02525	0.4339	0.2051	0.5	0.02227	0.1831	0.07065	0.3153	0.1245	0.5908
5	0.00591	0.8233	0.05932	0.2168	0.343	0.2256	0.1619	0.7742	0.1604	0.1394
26	0.1753	0.6463	0.00645	0.1062	0.067	0.5529	0.08797	0.7869	0.5565	0.4102
8	0.2437	0.01834	0.636	0.1973	0.1805	0.3179	0.04027	0.233	0.09351	0.3893
20	0.1938	0.3675	0.2034	0.6907	0.2432	0.09246	0.09614	0.8369	0.5275	0.5744
2	0.09539	0.1837	0.5	0.5	0.5	NaN	0.3451	0.5651	0.2071	0.8445
29	0.1898	0.02361	0.1314	0.09335	0.4726	0.4771	0.1451	0.2294	0.563	0.9998
19	0.1383	0.05532	0.1888	0.2655	0.38	0.8851	0.6367	0.2223	0.6828	0.387
21	0.2829	0.04531	0.0004397	NaN	0.0009066	0.02103	0.2504	0.002755	0.7929	0.7784
12	0.07476	0.6324	0.2468	0.0364	0.5362	0.5	0.5	0.2379	0.3155	0.3834
13	0.3778	0.02407	0.3693	0.03366	0.5949	0.2871	0.8504	0.04911	0.3276	0.03466
27	0.9074	0.4205	0.3749	0.5	0.4687	0.4039	0.2621	0.3505	0.8687	0.4793
7	0.04997	0.07778	0.486	0.6847	0.04683	0.372	0.2491	0.8787	0.2823	0.8979
25	0.375	6.928e-73	0.5	0.5	0.5	0.1913	0.5	0.9711	0.8964	0.7433
6	0.5207	0.7523	0.5346	0.649	0.1478	0.0747	0.05563	0.5698	0.5205	0.9192



Repeatability



AoV model: Sticky \sim Product + Session

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$Ftest
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	Sum Sq	Df	CM	F value	Pr(>F)
Product	40.417	5	8.0833	0.9528	0.5205
Session	30.083	1	30.0833	3.5462	0.1184
Residuals	42.417	5	8.4833		

	CocoaA	MikA	CocoaF	MikF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency	Crunchy	Melting	Sticky	Granular
1	0.7746	1.065	0.8563	0.6325	1.317	0.8563	0.5774	1.528	1.483	1.072	1.826	1.466	1.919	2.236
2	1.39	0.9661	1.323	0.6952	1.658	0.5916	1.372	1.155	1.372	0	0.5323	1.77	1.238	1.949
3	0.9661	1.041	1	1.218	1	1.789	0.9399	2.086	1.155	0.6325	1.372	2.585	1.323	1.844
4	1.155	2.07	1.713	2.179	2.269	1.713	3.514	2.408	1.884	2.646	2.781	0.9747	1.673	3.561
5	1.238	2.342	1.245	0.5323	1.317	1.789	0.8266	1.072	1.155	1.732	1.39	2.309	1.297	1.597
6	2.28	1.983	0.8944	1.597	1.844	1.756	1.183	1.041	2.164	1.653	0.7746	2.426	2.913	1.218
7	3.447	3.014	2.384	2.556	2.817	2.342	1.133	1.218	3.645	3.651	1.592	1.718	1.919	2.855
8	2.569	2.342	1.39	1.245	3.589	1.698	1.775	1.884	2.559	2.176	1.673	1.528	1.698	1.983
9	1.041	1.183	1.072	1.718	1.065	1.511	0.5323	1.443	1.812	1.653	1.884	1.713	1.653	2.164
10	1.218	1.533	1.072	0.3651	1.323	1.461	1.461	0.3651	1.39	1.511	0.5774	1.317	1.658	1.041
11	1.826	0.8266	1.88	0.9399	0.7303	1.238	1.245	0.3651	1.414	2.661	1.297	1.041	1.756	0.8266
12	1.576	1.576	1.511	0.866	2.477	1.576	0.9661	2.21	1.218	0.3651	1.638	2.266	2.129	1.065
13	1.238	1.653	0.8563	0.9399	1.041	0.5323	2.342	2.436	2.855	1.511	2	1.095	1.183	2.52
14	0.5323	0.8266	0.7746	1.461	0.5774	0.5774	1.39	1	1.133	0.5323	1.39	0.8563	1.065	0.9747
15	0.9661	1.658	0.5323	1.866	1.245	1.297	1.971	1.713	1.528	1.245	1.549	1.971	0.6952	1.592
16	1.732	1.638	1.065	1.162	0.9747	1.826	0.5323	1.533	0.8266	0.9747	1.756	0.7303	2.07	2.898
17	1.932	1.983	1.133	1.612	0.7416	0.7416	1.466	2.366	1.83	1.971	1.218	1.39	2.037	1.713
18	2.748	1.866	1.072	0.7746	2.037	1.971	1.218	1.549	1.065	2.164	1.83	2.661	1.812	0.2887
19	1.39	1.732	1.83	1.653	1.713	1.218	1.372	1	2.021	1.528	1.065	0.9747	1.718	0.9747
20	3.337	3.943	2.633	1.713	2.21	2.191	3.066	2.671	1.812	2.033	2.436	2.598	2.913	2.671
21	1.39	0.5323	1.987	0.7746	0.3873	0	1.971	0.3651	1.466	1.065	2.033	1.218	1.826	2.117
22	1.866	1.949	1.245	1.372	0.866	0	1.317	1.443	1.323	0.5916	1.155	1.77	1.323	3.309
23	1.756	1.866	0.8944	1.041	0.8563	1.238	0.9747	1.155	1.317	0.8266	1.826	1.155	2.309	0.5916
24	0.8563	0.9747	0.6952	1.612	1.065	0.7416	0.9399	1.443	1.155	1.718	0.8563	1.414	1.698	2.164
25	1.317	2.133	0.866	1.756	1.483	1.732	1.155	0.5323	0.7416	1.756	1.065	1.926e-15	3.561	0.3651
26	1.183	2.507	1.88	1.713	0.9747	0.6325	2.176	1.041	1.983	1.844	1.041	1.77	1.789	0.9399
27	1.155	1.612	0.9399	1.732	1.511	1.162	2.913	1.866	1.133	1.528	0.6952	1.133	1.713	0.6952
28	1.323	0.866	0.8944	0.8563	1.638	0.9747	0.2887	1.549	0.7303	1.528	1.592	1.372	1.238	2.033
29	3.935	2.426	2.255	3.058	2.608	2.394	2.745	2.828	1.77	2.449	2.817	1.317	2.082	0.8266

	CocoaF	Vanilla	Caramel	Sweetness	MIKF	CocoaA	Bitterness	Melting	Acidity	Astringency	Crunchy	MikA	Granular	Sticky	median
14	0.7746	0.5774	0.5774	1.39	1.461	0.5323	1.133	0.8563	1	0.5323	1.39	0.8266	0.9747	1.065	0.9155
24	0.6952	0.7416	1.065	0.9399	1.612	0.8563	1.155	1.414	1.443	1.718	0.8563	0.9747	2.164	1.698	1.11
23	0.8944	1.238	0.8563	0.9747	1.041	1.756	1.317	1.155	1.155	0.8266	1.826	1.866	0.5916	2.309	1.155
3	1	1.789	1	0.9399	1.218	0.9661	1.155	2.585	2.086	0.6325	1.372	1.041	1.844	1.323	1.186
1	0.8563	0.8563	1.317	0.5774	0.6325	0.7746	1.483	1.466	1.528	1.072	1.826	1.065	2.236	1.919	1.194
25	0.866	1.732	1.483	1.155	1.756	1.317	0.7416	1.926e-15	0.5323	1.756	1.065	2.133	0.3651	3.561	1.236
11	1.88	1.238	0.7303	1.245	0.9399	1.826	1.414	1.041	0.3651	2.661	1.297	0.8266	0.8266	1.756	1.242
28	0.8944	0.9747	1.638	0.2887	0.8563	1.323	0.7303	1.372	1.549	1.528	1.592	0.866	2.033	1.238	1.281
2	1.323	0.5916	1.658	1.372	0.6952	1.39	1.372	1.77	1.155	0	0.5323	0.9661	1.949	1.238	1.281
21	1.987	0	0.3873	1.971	0.7746	1.39	1.466	1.218	0.3651	1.065	2.033	0.5323	2.117	1.826	1.304
5	1.245	1.789	1.317	0.8266	0.5323	1.238	1.155	2.309	1.072	1.732	1.39	2.342	1.597	1.297	1.307
10	1.072	1.461	1.323	1.461	0.3651	1.218	1.39	1.317	0.3651	1.511	0.5774	1.533	1.041	1.658	1.32
22	1.245	0	0.866	1.317	1.372	1.866	1.323	1.77	1.443	0.5916	1.155	1.949	3.309	1.323	1.323
27	0.9399	1.162	1.511	2.913	1.732	1.155	1.133	1.133	1.866	1.528	0.6952	1.612	0.6952	1.713	1.336
16	1.065	1.826	0.9747	0.5323	1.162	1.732	0.8266	0.7303	1.533	0.9747	1.756	1.638	2.898	2.07	1.347
13	0.8563	0.5323	1.041	2.342	0.9399	1.238	2.855	1.095	2.436	1.511	2	1.653	2.52	1.183	1.375
19	1.83	1.218	1.713	1.372	1.653	1.39	2.021	0.9747	1	1.528	1.065	1.732	0.9747	1.718	1.459
15	0.5323	1.297	1.245	1.971	1.866	0.9661	1.528	1.971	1.713	1.245	1.549	1.658	1.592	0.6952	1.538
12	1.511	1.576	2.477	0.9661	0.866	1.576	1.218	2.266	2.21	0.3651	1.638	1.576	1.065	2.129	1.576
9	1.072	1.511	1.065	0.5323	1.718	1.041	1.812	1.713	1.443	1.653	1.884	1.183	2.164	1.653	1.582
17	1.133	0.7416	0.7416	1.466	1.612	1.932	1.83	1.39	2.366	1.971	1.218	1.983	1.713	2.037	1.663
6	0.8944	1.756	1.844	1.183	1.597	2.28	2.164	2.426	1.041	1.653	0.7746	1.983	1.218	2.913	1.705
26	1.88	0.6325	0.9747	2.176	1.713	1.183	1.983	1.77	1.041	1.844	1.041	2.507	0.9399	1.789	1.741
18	1.072	1.971	2.037	1.218	0.7746	2.748	1.065	2.661	1.549	2.164	1.83	1.866	0.2887	1.812	1.821
8	1.39	1.698	3.589	1.775	1.245	2.569	2.559	1.528	1.884	2.176	1.673	2.342	1.983	1.698	1.829
4	1.713	1.713	2.269	3.514	2.179	1.155	1.884	0.9747	2.408	2.646	2.781	2.07	3.561	1.673	2.125
29	2.255	2.394	2.608	2.745	3.058	3.935	1.77	1.317	2.828	2.449	2.817	2.426	0.8266	2.082	2.438
7	2.384	2.342	2.817	1.133	2.556	3.447	3.645	1.718	1.218	3.651	1.592	3.014	2.855	1.919	2.47
20	2.633	2.191	2.21	3.066	1.713	3.337	1.812	2.598	2.671	2.033	2.436	3.943	2.671	2.913	2.616
median	1.072	1.297	1.317	1.317	1.372	1.39	1.414	1.414	1.443	1.528	1.549	1.658	1.713	1.718	1.347

AoV model: Sticky ~ Product + Session

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$Ftest
```

	Sum Sq	Df	CM	F value	Pr(>F)
Product	40.417	5	8.0833	0.9528	0.5205
Session	30.083	1	30.0833	3.5462	0.1184
Residuals	42.417	5	8.4833		

$$F_{obs} = \frac{SS_{Product} / df_{Product}}{SS_{residual} / df_{residual}}$$

AoV model: Sticky ~ Product + Session

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$Ftest
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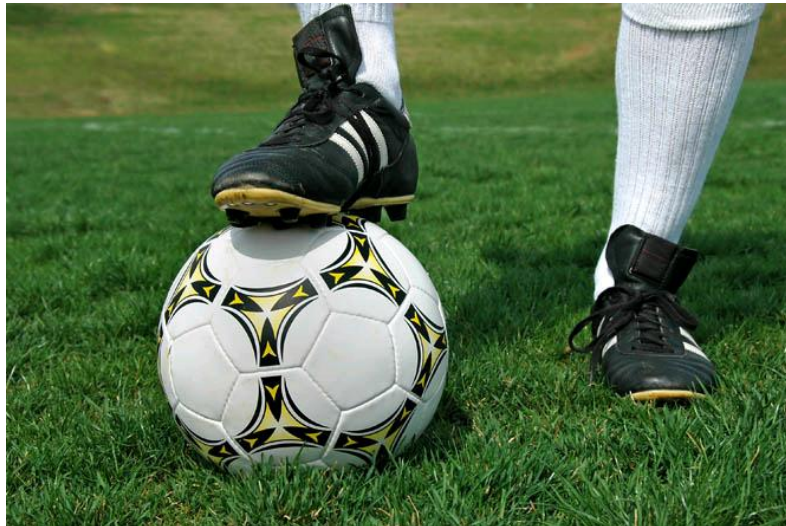
	Sum Sq	Df	CM	F value	Pr(>F)
Product	40.417	5	8.0833	0.9528	0.5205
Session	30.083	1	30.0833	3.5462	0.1184
Residuals	42.417	5	8.4833		

$$F_{obs} = \frac{SS_{Product} / df_{Product}}{SS_{residual} / df_{residual}}$$

Sensory performance

To constitute a good team...

- ...panelists have to be good performers but also have to get along
 - Agreement with the others





Agreement with the others: who are the others?

	MilkF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency	Crunchy	Melting	Sticky	Granular
choc1	1,57	1,67	1,10	3,14	4,66	7,07	4,76	5,97	4,74	3,76	3,45
choc2	2,38	2,78	1,81	4,62	3,14	4,95	3,16	7,71	4,33	3,83	3,16
choc3	7,71	6,33	3,67	7,60	1,57	1,40	1,21	2,98	7,31	5,03	1,60
choc4	2,59	2,67	2,12	4,29	3,93	5,19	3,69	6,10	4,38	4,10	3,55
choc5	3,12	3,41	1,79	5,22	3,09	4,88	3,10	6,64	4,74	3,22	3,07
choc6	3,36	3,26	1,91	5,62	2,67	4,19	2,76	7,33	4,21	3,93	3,17



AoV model: Sticky ~ Product + Session

\$Ttest

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	5.583333333	0.8407999	6.64050203	0.001167268
Product - choc1	-0.083333333	1.8800857	-0.04432422	0.966361675
Product - choc2	0.916666667	1.8800857	0.48756643	0.646482087
Product - choc3	-1.083333333	1.8800857	-0.57621487	0.589434985
Product - choc4	0.416666667	1.8800857	0.22162110	0.833375861
Product - choc5	-3.083333333	1.8800857	-1.63999617	0.161930452
Product - choc6	2.916666667	1.8800857	1.55134773	0.181516979

Adj. Mean

Product - choc1	5.500
Product - choc2	6.500
Product - choc3	4.500
Product - choc4	6.000
Product - choc5	2.500
Product - choc6	8.500



Agreement with the others

	MilkF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency	Crunchy	Melting	Sticky	Granular
choc1	1,57	1,67	1,10	3,14	4,66	7,07	4,76	5,97	4,74	3,76	3,45
choc2	2,38	2,78	1,81	4,62	3,14	4,95	3,16	7,71	4,33	3,83	3,16
choc3	7,71	6,33	3,67	7,60	1,57	1,40	1,21	2,98	7,31	5,03	1,60
choc4	2,59	2,67	2,12	4,29	3,93	5,19	3,69	6,10	4,38	4,10	3,55
choc5	3,12	3,41	1,79	5,22	3,09	4,88	3,10	6,64	4,74	3,22	3,07
choc6	3,36	3,26	1,91	5,62	2,67	4,19	2,76	7,33	4,21	3,93	3,17

Agreement with the others

	MilkF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency	Crunchy	Melting	Sticky	Granular
choc1	1,57	1,67	1,10	3,14	4,66	7,07	4,76	5,97	4,74	3,76	3,45
choc2	2,38	2,78	1,81	4,62	3,14	4,95	3,16	7,71	4,33	3,83	3,16
choc3	7,71	6,33	3,67	7,60	1,57	1,40	1,21	2,98	7,31	5,03	1,60
choc4	2,59	2,67	2,12	4,29	3,93	5,19	3,69	6,10	4,38	4,10	3,55
choc5	3,12	3,41	1,79	5,22	3,09	4,88	3,10	6,64	4,74	3,22	3,07
choc6	3,36	3,26	1,91	5,62	2,67	4,19	2,76	7,33	4,21	3,93	3,17

Adj. Mean

Product - choc1 5.500
Product - choc2 6.500
Product - choc3 4.500
Product - choc4 6.000
Product - choc5 2.500
Product - choc6 8.500

Correlation: 0.16

Agreement between panelists

	CocoaA	MikA	CocoaF	MikF	Caramel	Vanilla	Sweetness	Acidity	Bitterness	Astringency	Crunchy	Melting	Sticky	Granular
1	0.7334	0.4104	0.8894	0.9523	0.9441	0.9049	0.9698	0.7375	0.924	0.338	0.9104	0.8502	0.5017	-0.2555
2	0.8392	0.3541	0.9564	0.9488	0.8957	0.8223	0.943	0.6848	0.9203		0.5977	0.8783	-0.08672	0.1608
3	0.8421	0.6238	0.9778	0.961	0.6564	0.8554	0.873	0.9708	0.8653	0.9187	0.717	0.6736	0.9002	0.5261
4	0.8924	0.9577	0.5888	0.9675	0.5206	0.8043	0.5673	0.8089	0.8621	0.9453	0.87	0.7509	-0.06811	0.4986
5	0.2815	0.09322	0.8742	0.7277	0.7666	0.5328	0.8387	-0.5382	0.8328	0.6348	0.4388	0.4177	0.3701	0.6288
6	0.3436	0.2292	0.6057	0.7093	0.8875	-0.2852	-0.3552	0.5706	0.6628	0.7819	0.08185	-0.07926	0.163	0.1021
7	0.05817	-0.3704	0.2793	0.634	0.08515	-0.3887	0.5137	0.7467	0.5695	0.8277	0.9404	0.6804	-0.6296	0.8957
8	0.8826	0.6623	0.9444	0.9683	0.7301	0.3318	0.7609	0.6712	0.8521	0.5134	0.9473	0.6488	0.8635	0.5955
9	0.7196	0.8141	0.8649	0.8836	0.9066	0.8844	0.8255	0.9493	0.8638	0.8951	0.9522	0.8607	0.2831	0.4922
10	0.824	0.811	0.8203	0.9577	0.7811	0.4112	0.8	-0.04626	0.6762	0.837	0.9271	0.8093	0.8156	0.4546
11	-0.0121	-0.3356	0.5871	0.941	0.9771	0.7304	0.955	0.3846	0.906	0.5124	0.711	0.8826	0.4543	0.4983
12	0.8218	0.8573	0.9514	0.9366	0.7628	0.7607	0.6786	0.5082	0.9306	0.01145	0.9849	0.7543	0.7921	0.4974
13	0.9202	0.95	0.9678	0.9927	0.9598	0.9226	0.8505	0.9013	0.8637	-0.0005304	0.7413	0.4672	0.1617	0.4845
14	0.548	0.5298	0.9477	0.9818	0.8776	0.5999	0.8733	-0.4641	0.9474	0.6715	0.6523	0.7465	-0.4553	0.3539
15	0.8385	0.4069	0.9055	0.9053	0.9589	0.9526	0.9374	-0.05098	0.7919	0.8243	0.9216	0.7561	0.8357	-0.8101
16	0.6995	0.9286	0.6575	0.8607	0.7531	0.8482	0.6982	0.3331	0.6931	0.8268	0.9137	0.3006	0.05261	0.1963
17	0.8175	0.8067	0.9324	0.9838	0.9578	0.8649	0.961	0.833	0.8923	0.7082	0.8229	0.8335	0.3592	0.3137
18	0.9002	0.5048	0.8749	0.9795	0.9624	0.7464	0.7219	0.8823	0.6564	0.6522	0.812	0.3433	0.5835	0.4243
19	0.7455	0.8018	0.916	0.9599	0.4711	-0.07294	0.8972	0.8205	0.9637	-0.5127	0.9644	0.6076	0.4799	0.1705
20	0.728	0.3829	0.9718	0.9835	0.9096	0.6554	0.9333	0.6039	0.8991	0.8542	0.832	0.551	0.6194	0.6507
21	0.7508	0.5193	0.1168	0.8813	0.9546		0.925	0.6631	0.7173	0.8358	0.8769	0.6274	0.2601	0.824
22	0.7045	0.7205	0.772	0.713	0.9222		0.5522	0.6999	0.7901	0.7933	0.84	0.9178	0.8379	0.76
23	-0.1155	-0.1197	0.9596	0.9458	0.954	0.9006	0.7354	0.8131	0.9336	0.9106	0.904	0.78	0.7565	0.241
24	0.951	0.8208	0.9478	0.9484	0.9335	0.91	0.9	0.9454	0.9111	0.911	0.7328	0.7654	0.85	0.3664
25	0.365	-0.4481	0.7863	0.9248	0.0437	-0.1577	0.8384	-0.1767	0.9126	0.8927	0.9286	-0.5315	-0.0962	-0.3861
26	0.154	-0.1284	0.8996	0.7104	0.6082	0.6775	0.9108	0.03104	0.9139	0.3609	0.9721	0.9723	0.69	0.6869
27	0.6748	0.4844	0.9914	0.3584	0.6069	0.1322	0.04077	0.3063	0.5218	0.9021	0.8174	-0.342	0.7043	0.1244
28	0.9528	0.9869	0.8977	0.9553	0.9146	0.8849	0.9497	0.6801	0.9636	0.8471	0.6675	0.8957	0.8533	0.8734
29	0.5397	-0.242	0.8527	0.8657	0.6865	0.8869	0.9253	0.7863	0.758	0.6422	0.7882	0.4283	0.04591	0.431

Agreement between panelists

	Granular	Sticky	MIKA	Acidity	CocoaA	Melting	Vanilla	Astringency	Crunchy	Sweetness	Bitterness	Caramel	CocoaF	MIKF	median
25	-0.3861	-0.0962	-0.4481	-0.1767	0.365	-0.5315	-0.1577	0.8927	0.9286	0.8384	0.9126	0.0437	0.7863	0.9248	0.2043
6	0.1021	0.163	0.2292	0.5706	0.3436	-0.07926	-0.2852	0.7819	0.08185	-0.3552	0.6628	0.8875	0.6057	0.7093	0.2864
27	0.1244	0.7043	0.4844	0.3063	0.6748	-0.342	0.1322	-0.9021	0.8174	0.04077	0.5218	0.6069	0.9914	0.3584	0.5031
7	0.8957	-0.6296	-0.3704	0.7467	0.05817	0.6804	-0.3887	0.8277	0.9404	0.5137	0.5695	0.08515	0.2793	0.634	0.5416
5	0.6288	0.3701	0.09322	-0.5382	0.2815	0.4177	0.5328	0.6348	0.4388	0.8387	0.8328	0.7666	0.8742	0.7277	0.5808
11	0.4983	0.4543	-0.3356	0.3846	-0.0121	0.8826	0.7304	0.5124	0.711	0.955	0.906	0.9771	0.5871	0.941	0.6491
14	0.3539	-0.4553	0.5298	-0.4641	0.548	0.7465	0.5999	0.6715	0.6523	0.8733	0.9474	0.8776	0.9477	0.9818	0.6619
26	0.6869	0.69	-0.1284	0.03104	0.154	0.9723	0.6775	0.3609	0.9721	0.9108	0.9139	0.6082	0.8996	0.7104	0.6885
16	0.1963	0.05261	0.9286	0.3331	0.6995	0.3006	0.8482	0.8268	0.9137	0.6982	0.6931	0.7531	0.6575	0.8607	0.6989
29	0.431	0.04591	-0.242	0.7863	0.5397	0.4283	0.8869	0.6422	0.7882	0.9253	0.758	0.6865	0.8527	0.8657	0.7222
18	0.4243	0.5835	0.5048	0.8823	0.9002	0.3433	0.7464	0.6522	0.812	0.7219	0.6564	0.9624	0.8749	0.9795	0.7341
8	0.5955	0.8635	0.6623	0.6712	0.8826	0.6488	0.3318	0.5134	0.9473	0.7609	0.8521	0.7301	0.9444	0.9683	0.7455
21	0.824	0.2601	0.5193	0.6631	0.7508	0.6274		0.8358	0.8769	0.925	0.7173	0.9546	0.1168	0.8813	0.7508
22	0.76	0.8379	0.7205	0.6999	0.7045	0.9178		0.7933	0.84	0.5522	0.7901	0.9222	0.772	0.713	0.772
19	0.1705	0.4799	0.8018	0.8205	0.7455	0.6076	-0.07294	-0.5127	0.9644	0.8972	0.9637	0.4711	0.916	0.9599	0.7736
12	0.4974	0.7921	0.8573	0.5082	0.8218	0.7543	0.7607	0.01145	0.9849	0.6786	0.9306	0.7628	0.9514	0.9366	0.7774
20	0.6507	0.6194	0.3829	0.6039	0.728	0.551	0.6554	0.8542	0.832	0.9333	0.8991	0.9096	0.9718	0.9835	0.78
4	0.4986	-0.06811	0.9577	0.8089	0.8924	0.7509	0.8043	0.9453	0.87	0.5673	0.8621	0.5206	0.5888	0.9675	0.8066
10	0.4546	0.8156	0.811	-0.04626	0.824	0.8093	0.4112	0.837	0.9271	0.8	0.6762	0.7811	0.8203	0.9577	0.8102
17	0.3137	0.3592	0.8067	0.833	0.8175	0.8335	0.8649	0.7082	0.8229	0.961	0.8923	0.9578	0.9324	0.9838	0.8333
15	-0.8101	0.8357	0.4069	-0.05098	0.8385	0.7561	0.9526	0.8243	0.9216	0.9374	0.7919	0.9589	0.9055	0.9053	0.8371
2	0.1608	-0.08672	0.3541	0.6848	0.8392	0.8783	0.8223		0.5977	0.943	0.9203	0.8957	0.9564	0.9488	0.8392
23	0.241	0.7565	-0.1197	0.8131	-0.1155	0.78	0.9006	0.9106	0.904	0.7354	0.9336	0.954	0.9596	0.9458	0.8569
3	0.5261	0.9002	0.6238	0.9708	0.8421	0.6736	0.8554	0.9187	0.717	0.873	0.8653	0.6564	0.9778	0.961	0.8604
9	0.4922	0.2831	0.8141	0.9493	0.7196	0.8607	0.8844	0.8951	0.9522	0.8255	0.8638	0.9066	0.8649	0.8836	0.8644
1	-0.2555	0.5017	0.4104	0.7375	0.7334	0.8502	0.9049	0.338	0.9104	0.9698	0.924	0.9441	0.8894	0.9523	0.8698
13	0.4845	0.1617	0.95	0.9013	0.9202	0.4672	0.9226	-0.0005304	0.7413	0.8505	0.8637	0.9598	0.9678	0.9927	0.8825
28	0.8734	0.8533	0.9869	0.6801	0.9528	0.8957	0.8849	0.8471	0.6675	0.9497	0.9636	0.9146	0.8977	0.9553	0.8967
24	0.3664	0.85	0.8208	0.9454	0.951	0.7654	0.91	0.911	0.7328	0.9	0.9111	0.9335	0.9478	0.9484	0.9105
median	0.4546	0.4799	0.5193	0.6801	0.7334	0.7465	0.7607	0.8088	0.84	0.8505	0.8638	0.8875	0.8977	0.9458	0.7736

● ● ● | Let's then have a look at all the panelists





The AoV model

$$\forall (i, j, k) \quad Y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_k + \alpha\beta_{ij} + \alpha\gamma_{ik} + \beta\gamma_{jk} + \varepsilon_{ijk}$$

$$L(\varepsilon_{ijk}) = N(0, \sigma) \quad \text{et} \quad \text{cov}(\varepsilon_{ijk}, \varepsilon_{i'j'k'}) = 0 \quad \forall (i, j, k) \neq (i', j', k')$$

μ The mean effect

α_i The product effect

β_j The panelist effect

γ_k The session effect

$\alpha\beta_{ij}$ The interaction product — panelist effect

$\alpha\gamma_{ik}$ The interaction product — session effect

$\beta\gamma_{jk}$ The interaction panelist — session effect



What do you care about most?

- The product effect
 - You want the panelists to make differences among the products
- The product-session interaction effect
 - You want the panelists to be repeatable from one session to the others
- The product-panelist interaction effect
 - You want the panelists to be agree with each other (consensus)

Panel performance (sorted by product P-value)

	Product	Panelist	Session	Product:Panelist	Product:Session	Panelist:Session	median
MilkF	3.74e-40	7.512e-11	0.09243	0.006824	0.1182	0.01535	0.01109
Bitterness	1.875e-29	1.639e-10	0.01195	0.0258	0.1897	0.05538	0.01888
CocoaF	1.748e-28	1.997e-11	0.0971	0.00665	0.4487	0.09411	0.05038
Crunchy	2.878e-27	2.88e-14	0.05463	0.02381	0.6869	0.004479	0.01414
Sweetness	1.106e-24	2.416e-12	0.06177	0.1177	0.1188	0.003246	0.03251
Caramel	1.183e-22	2.386e-23	0.9486	0.00312	0.07315	0.0008459	0.001983
Astringency	1.467e-15	1.142e-22	0.9396	0.05936	0.08183	0.05854	0.05895
CocoaA	8.85e-14	2.552e-08	0.2392	0.9929	0.8011	0.8256	0.5202
Melting	4.577e-12	1.202e-17	0.1179	6.88e-05	0.3041	0.06195	0.03101
Acidity	5.263e-11	6.143e-25	0.5322	0.0009151	0.9835	0.008124	0.004519
Vanilla	2.785e-10	9.748e-23	0.2272	0.002577	0.3183	0.03775	0.02016
MilkA	6.442e-08	1.097e-13	0.2885	0.09279	0.8287	0.2333	0.163
Granular	9.083e-05	2.32e-21	0.1471	0.01502	0.283	0.3101	0.08107
Sticky	0.0005312	8.365e-21	0.4728	0.05412	0.009964	0.04789	0.02893