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UniODA *vs.* Chi-Square: Audience Effect on Smile Production in Infants

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This study compares 10-month-old infant smile status and inter-glance interval for attentive versus inattentive mothers. Statistical analysis by chi-square found no significant effects, while UniODA found that infants with inattentive mothers smile less often, with greater inter-glance intervals.

Investigating smile production in 10-month-old infants, Jones, Collins and Hong[1] compared type of smile and inter-glance interval for attentive versus inattentive mothers (Table 1). Inter-glance interval (in seconds) was arbitrarily split into five levels. These levels were considered to be categorical, rather than ordinal, to enable statistical analysis via chi-square, despite marginal minimum expectations.[2] This erroneous practice is commonly seen in the applied literature.[3,4] Analysis via chi-square was unrevealing: "The distributions of inter-glance intervals preceding smiles in the Attentive and Inattentive conditions were not reliably different from one another or from the distributions for non-smiling glances in each condition. Furthermore, distributions of inter-glance intervals preceding S→M smiles were also the same in the Attentive and Inattentive conditions. Finally, the distributions of all inter-glance intervals did not differ in the two conditions" (p. 48).[1]

UniODA[3] was run using MegaODA[5-8] software. The class variable was mother's attention status (0=inattentive, 1=attentive). The dummy-coded attributes were infant's smile status (1=S→M, 2=M→S, 3=No Smile), and inter-glance interval (1=≤5 secs, 2=6-15 secs, 3=16-30 secs, 4=31-60 secs, 5=>60 secs).

Table 1: Inter-glance interval preceding anticipatory smiles to mother (S→M), smiles during glances (M→S), and non-smiling glances to mother (No Smile), for attentive and inattentive mothers (Jones et al., 1991).

Attentive Mother Condition

Inter-glance Interval	Infant Smile Status S→M	M→S	No Smile
≤ 5 secs	8	2	10
6-15 secs	8	7	16
16-30 secs	13	4	16
31-60 secs	5	8	10
> 60 secs	4	4	8

Inattentive Mother Condition

Inter-glance Interval	Infant Smile Status S→M	M→S	No Smile
≤ 5 secs	1	0	9
6-15 secs	6	1	15
16-30 secs	1	3	14
31-60 secs	3	2	17
> 60 secs	5	4	15

Note: Tabled are frequency counts.

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For infant smile status the UniODA model was: if Smile=3 (No Smile) then predict class=Inattentive; otherwise predict class= Attentive. The model achieved a moderate ESS of 24.1 (p<0.0003), and results were stable in jackknife validity analysis. The model correctly classified 70 (73%) of 96 inattentive mothers, and 63 (51%) of 123 attentive mothers. A UniODA-based range test analysis[9,10] comparing only the two types of smiles was unrevealing (ESS=1.2, p<0.99).

For infant inter-glance interval the UniODA model was: if Interval≤3.5 (≤30 secs) then predict class=Attentive; otherwise predict class=Inattentive. The model achieved a weak ESS of 16.2 (p<0.011), and results were stable in jackknife validity analysis. The model correctly classified 46 (48%) of 96 inattentive mothers, and 84 (68%) of 123 attentive mothers.

In summary, while chi-square analysis found no statistically reliable effects, UniODA discovered that infants smile less often, with greater inter-glance intervals, with inattentive mothers. No multivariable model was possible: classification tree analysis[11,12] indicated only infant smile status entered the model.

In the present case it didn't matter (i.e., the UniODA model didn't change, and changes in p which occurred didn't change interpretation of the effect) whether interval was treated as being ordered, or categorical (i.e., by including interval in the CAT command[8]). It is unknown to what extent this is true in published literature, but it is recommended that in future research variables which truly are measured using an ordinal scale are treated as though they were in fact measured using an ordinal scale.[3]

References

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[3]Yarnold PR, Soltysik RC (2005). *Optimal data analysis: A guidebook with software for Windows*. Washington, DC: APA Books.

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[8]UniODA analysis was accomplished using the following MegaODA code (commands are indicated in red; non-directional exploratory analysis is conducted as there was no *a priori* hypothesis):

```
open data;
output smile.out;
vars mother smile  interval;
data;
1 1 1 (repeated 8 times)
1 1 2 (repeated 8 times)
1 1 3 (repeated 13 times)
1 1 4 (repeated 5 times)
1 1 5 (repeated 4 times)
1 2 1 (repeated 2 times)
1 2 2 (repeated 7 times)
1 2 3 (repeated 4 times)
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1 2 4 (repeated 8 times)
1 2 5 (repeated 4 times)
1 3 1 (repeated 10 times)
1 3 2 (repeated 16 times)
1 3 3 (repeated 16 times)
1 3 4 (repeated 10 times)
1 3 5 (repeated 8 times)
0 1 1 (repeated 1 time)
0 1 2 (repeated 6 times)
0 1 3 (repeated 1 time)
0 1 4 (repeated 3 times)
0 1 5 (repeated 5 times)
0 2 2 (repeated 1 time)
0 2 3 (repeated 3 times)
0 2 4 (repeated 2 times)
0 2 5 (repeated 4 times)
0 3 1 (repeated 9 times)
0 3 2 (repeated 15 times)
0 3 3 (repeated 14 times)
0 3 4 (repeated 17 times)
0 3 5 (repeated 15 times)
end;
class mother;
attr smile interval;
cat smile;
mcarlo iter 25000;
loo;go;
ex smile=3;
go;
```

[9]Yarnold PR, Brofft GC (2013). ODA range test *vs*. one-way analysis of variance: Comparing strength of alternative line connections. *Optimal Data Analysis*, 2, 198-201.

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