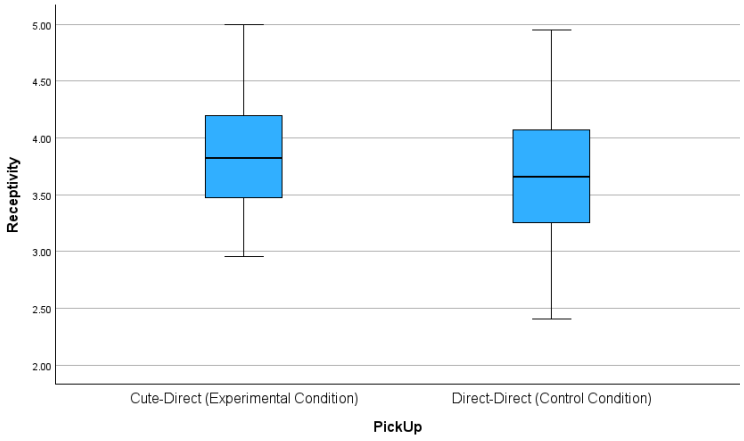
Main Research Question: How do pick-up lines and a person's scent influence relationship initiation?
Dataset: "PickUpLines.sav"

All the answers (except the ones about mean scores) **need to be justified**, e.g. if you say that there is homogeneity of variance, provide evidence for your claim, if you transformed a variable, explain why.

RQ1: Is there any evidence to suggest that the cute-direct pick-up approach will lead to more relationship receptivity than the direct-direct approach?

1. What is your dependent variable?
   Ans: Receptivity
2. What is(are) your independent variable(s)?
   Ans: PickUp
3. Are the scores in each cell independent?
   Ans: Yes. PickUp approach of each individual is independent of others, ie. it belongs to either one of the categories only.
4. Are there any significant outliers?
   Ans: No. From the box plots, there are no significant outliers.



5. How is your dependent variable distributed in each cell?
   Ans: No.
   Receptivity is normally distributed for Direct-Direct (Control) pick-up approach. P-value = 0.871.
   Receptivity is not normally distributed for Cute-Direct(Experimental) pick-up approach. P-value < 0.001
6. Do you need to perform any transformations?
   Ans: I converted the PickUp column to Nominal type. This helps with creating groups based on the PickUp type.
7. Is there homogeneity or heterogeneity of variance?
   Ans: Yes, there is homogeneity of variance. We use Lavene's test, p-value = 0.282. With p>0.05 – we say that there is homogeneity of variance.
8. What is the mean score of receptivity in the experimental condition?
   Ans: Mean = 3.86 95%CI [3.77,3.95], SD = 0.498

9. What is the mean score of receptivity in the control condition?
   Ans: Mean = 3.65 95% CI [3.52, 3.78], SD = 0.558
10. What is your answer to RQ1? Report on the findings (no less than 150 words). Don't forget to mention the assumptions.
    A one-way ANOVA was conducted to suggest if the cute-direct pick-up approach will lead to more relationship receptivity than the direct-direct approach.

    There is independence of observations as the values for independent respondents.
    Participants were classified into two groups based on PickUp: Direct-Direct (N=74), Cute-Direct (N=120) - unequal samples.
    There were no outliers, as assessed by boxplot.
    The groups were assessed using Shapiro-Wilk test for normality:
    Receptivity - normal, Direct-Direct group. p = 0.871.
    - not normal, Cute-Direct group. p < 0.001
    There was homogeneity of variances, as assessed by Levene's test p= 0.282.
    Data is presented as mean ±standard deviation.

    We check the results of Welch's ANOVA as the data is not normal in all groups and we have different sample sizes.

    ANOVA Test - F(1,192) = 7.324, p=0.007 and eta-squared = 0.037
    Welch's ANOVA Test - F(1, 141.24) = 6.940, p=0.009

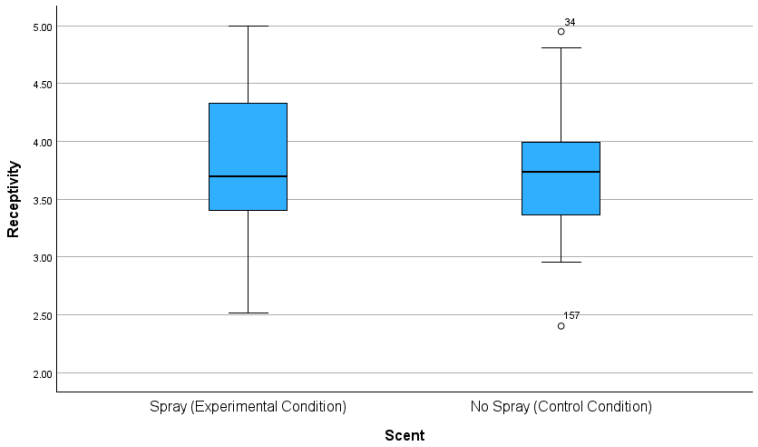
    From Welch's ANOVA results, the mean Receptivity was statistically significantly different between the two groups based on PickUp.

    The mean of receptivity:
    Cute-Direct: 3.86 95%CI [3.77,3.95], SD=0.498
    Direct-Direct: 3.65 95%CI [3.52, 3.78], SD=0.558

    Cute-Direct approach has a statistically significant higher mean of Receptivity than Direct-Direct approach.

RQ2: Is there any evidence to suggest that the presence of androstadienone spray will lead to more relationship receptivity than no spray?

11. What is your dependent variable?
    Ans: Receptivity
12. What is(are) your independent variable(s)?
    Ans: Spray
13. Are the scores in each cell independent?
    Ans: Yes. Scent of each individual is independent of others, ie. it belongs to either one of the categories only
14. Are there any significant outliers?
    Ans: No. There are no significant outliers, as observed from the box plots.



15. How is your dependent variable distributed in each cell?
    Ans: No. We use Shapiro-Wilk test. p-value for both groups = 0.036.
16. Do you need to perform any transformations?
    Ans: Yes. Convert the Scent column to Nominal type.
17. Is there homogeneity or heterogeneity of variance?
    Ans: No. There is heterogeneity of variance. $p < 0.001$. This means that the groups are different.
18. What is the mean score of receptivity in the experimental condition?
    Ans: Group with Spray = Mean: 3.8569, 95% CI[3.74, 3.97] SD: 0.60
19. What is the mean score of receptivity in the control condition?
    Ans: Group with No Spray = Mean: 3.6992, 95% CI[3.61, 3.79] SD: 0.42
20. What is your answer to RQ2? Report on the findings (no less than 150 words). Don't forget to mention the assumptions.
    A one-way ANOVA was conducted to suggest if that the presence of androstadiene spray will lead to more relationship receptivity than no spray.

    Participants were classified into two groups: Spray (N=104), No Spray (N=90) - independent samples with similar sizes.
    There were no significant outliers, as assessed by boxplot.
    The groups were assessed using Shapiro-Wilk test for normality:
    Receptivity - not normal, Spray group. p = 0.036.
    - not normal, No Spray group. p = 0.036

    There was no homogeneity of variances, as assessed by Levene's test $p<0.001$
    Data is presented as mean ±standard deviation.

    As the data is not normal and there is no homogeneity of variances, we look at the results of Welch ANOVA

    ANOVA Test - $F(1,192) = 4.331$, $p=0.039$ and eta-squared = 0.022
    Welch's ANOVA Test - $F(1, 184.031) = 4.553$, $p=0.034$

    As $p < 0.05$ it means that the difference between the group means is significant.

The mean Receptivity is greater in group using 'Spray' compared to group with 'No Spray

The mean of receptivity:

Group with Spray = Mean: 3.8569, 95% CI[3.74, 3.97] SD: 0.60
Group with No Spray = Mean: 3.6992, 95% CI[3.61, 3.79] SD: 0.42

Presence of androstadiene spray has a statistically significant higher mean of Receptivity than no spray.

RQ3: Is there any evidence to suggest that the impact of the androstadienone spray on attractiveness effect will be enhanced by the pick-up approach?

21. What is your dependent variable?
    Ans: Receptivity
22. What is(are) your independent variable(s)?
    Ans: Scent and PickUp
23. Are the scores in each cell independent?
    Ans: Yes. Respondents are independent; hence the recorded values are as well.
24. Are there any significant outliers?
    Ans: No. There are no statistically significant outliers; as evident from boxplots of the Receptivity of different groups
25. How is your dependent variable distributed in each cell?
    Ans: We perform Shapiro Wilk test for each group:
    1. Spray – Cute-Direct – Not Normal, p = 0.011
    2. Spray – Direct-Direct – Normal, p = 0.120
    3. No Spray – Cute-Direct – Normal, p = 0.062
    4. No Spray – Cute-Direct – Normal, p = 0.435
26. Do you need to perform any transformations?
    Ans: PickUp and Scent are already converted to Nominal type.
27. Is there homogeneity or heterogeneity of variance?
    Ans: No. There is no homogeneity of variance. Levene's test p < 0.001.

N.B. If group sample sizes are equal or approximately equal and large, there is normality and the ratio of the largest group variance to the smallest group variance is less than 3, the two-way ANOVA is somewhat robust to heterogeneity of variance in these circumstances (Jaccard, 1998).
Reminder: Standard deviation is square root of variance ($SD = \sqrt{Variance}$).

28. Is there any interaction between the two factors?
    Ans: Yes. There is a significant value of interaction between Pickup and Scent p=0.003, as seen from the Between-Subjects effects Pickup*Scent

29. What is your answer to RQ3? Report on the findings (no less than 200 words). Don't forget to mention the assumptions. You can use η^2 instead of ω^2.

A two-way ANOVA was conducted to examine if the impact of the androstadienone spray on attractiveness effect will be enhanced by the pick-up approach.

Residual analysis was performed to test for the assumptions of the two-way ANOVA.
Outliers were assessed by inspection of a boxplot,
normality was assessed using Shapiro-Wilk's normality test for each cell of the design and homogeneity of variances was assessed by Levene's test.
There were no outliers.
Data was normally distributed in groups –
Cute-Direct-No Spray (N=60) (p=0.062),
Direct-Direct-No Spray (N=30) (p=0.120),
Direct-Direct-Spray (N=44) (p=0.435)
and not normal in group - Cute-Direct-Spray (N=60) (p=0.011).

There was no homogeneity of variances as $p<0.001$

If group sample sizes are equal or approximately equal and large, there is normality and the ratio of the largest group variance to the smallest group variance is less than 3,
the two-way ANOVA is somewhat robust to heterogeneity of variance in these circumstances. (Jaccard, 1998)
Here this ratio is less than 3 - so we go ahead with two-way ANOVA. Post-hoc tests were not performed as no. of groups for each factor was less than three.

There was a statistically significant interaction between scent and pickup on receptivity of relationship, $F(1, 190) = 9.113$, $p = .003$, partial $\eta2 = .046$. All pairwise-comparisons were run for each simple main effect with reported 95% confidence intervals and p-values Bonferroni-adjusted with each main effect.

There was a statistically significant difference in mean receptivity for 'Spray' based on the pick up approach, $F(1, 190) = 18.101$, $p < 0.001$, eta-squared =0.087. Mean Difference of 0.427 95%CI [0.229,0.625] $p<0.001$ between Cute-Direct and Direct-Direct approach.

There is no statistically significant difference in mean receptivity for 'No Spray' based on the pick up approach. $F(1,190) = 0.068$, $p = 0.795$, eta-squared=0.

Cute-Direct-Spray (N=60) Mean: 4.037 95% CI [3.909, 4.166] SD: 0.56964
Direct-Direct-Spray (N=44) Mean: 3.611 95% CI [3.460, 3.761]SD: 0.56428
Cute-Direct-NoSpray (N=60) Mean: 3.689 95% CI [3.561, 3.818] SD: 0.340
Direct-Direct-NoSpray (N=30) Mean: 3.719 95% CI [3.537, 3.901] SD: 0.554

The impact of the presence of 'Spray' is enhanced by the 'Cute-Direct' pick-up approach.

30. Answer the main research question by taking the above findings into account (no less than 200 words). Don't forget to mention the assumptions.

Ans: The main research question seeks to explore how pick-up lines and the presence of androstadienone spray influence relationship initiation. The results of the three research questions suggest that both the pick-up approach and the presence of androstadienone spray play a significant role in enhancing relationship receptivity.

Taking the summary of the findings from above:

RQ1: Pick-Up Approach and Relationship Receptivity

The cute-direct pick-up approach was found to lead to higher relationship receptivity compared to the direct-direct approach. This conclusion was drawn based on Welch's ANOVA results which showed a statistically significant difference in receptivity between the two groups, with the cute-direct approach having a higher mean receptivity score (Mean = 3.86, 95% CI [3.77,3.95], SD = 0.498) compared to the direct-direct approach (Mean = 3.65, 95% CI [3.52, 3.78], SD = 0.558). **This suggests that the cute-direct approach is more effective in fostering receptivity for relationship initiation**. The homogeneity of variances was confirmed with Levene's test (p=0.282), and there were no significant outliers. The Shapiro-Wilk test indicated normal distribution for the direct-direct group but not for the cute-direct group.

RQ2: Androstadienone Spray and Relationship Receptivity

The presence of androstadienone spray also showed a significant effect on relationship receptivity. The group with the spray had a higher mean receptivity score (Mean = 3.8569, 95% CI [3.74, 3.97], SD = 0.60) compared to the group with no spray (Mean = 3.6992, 95% CI [3.61, 3.79], SD = 0.42). Welch's ANOVA results confirmed this significant difference (p=0.034). **The presence of the spray therefore seems to have a positive influence on receptivity to relationship initiation, indicating the potential role of scent in attraction**. The homogeneity of variances assumption was violated (Levene's test $p<0.001$), indicating heterogeneity of variance and there was non-normal distribution in both groups (Shapiro-Wilk test p=0.036), although with similar sample sizes.

RQ3: Interaction Between Pick-Up Approach and Scent

A two-way ANOVA revealed a statistically significant interaction between the pick-up approach and the presence of androstadienone spray on relationship receptivity ($F(1, 190) = 9.113$, $p = .003$, partial $\eta 2 = .046$). The cute-direct approach combined with the spray resulted in the highest receptivity scores (Mean = 4.037, 95% CI [3.909, 4.166], SD = 0.56964), significantly higher than the other combinations. **This interaction suggests that the impact of the androstadienone spray is enhanced by the cute-direct pick-up approach, highlighting the interaction between scent and approach style.** The normality assumption was violated for one group, and there was no homogeneity of variances (Levene's test $p<0.001$). However, given the robustness of the two-way ANOVA to these violations with large and equal sample sizes, the analysis was considered valid.

Conclusion

In conclusion, both the type of pick-up line and the presence of a scent (androstadienone spray) significantly influence relationship receptivity. The cute-direct approach and the spray both independently enhance receptivity, but their interaction further amplifies this effect. The findings suggest that a combination of a charming pick-up approach and the right scent can significantly improve the likelihood of a positive relationship initiation.