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?
Yes, there is evidence to suggest that the cute-direct pick-up approach will lead to more relationship receptivity than the direct-direct approach.

I've found statistically significant evidence difference to confirm that the distribution of Receptivity for the Cute-Direct group is different than for Direct-Direct group, meaning that the groups are different in distribution. According to the non-parametric test, there is also more frequency in higher values of Receptivity in the Cute-Direct group than in the Direct-Direct group.
Also, the mean score of Receptivity in the Cute-Direct group is higher than the Direct-Direct group. However it was not possible to conduct the One-Way ANOVA test, because the values for the Cute-Direct group are very non-normal (p = <.001).

1. **What is your dependent variable?**

The dependent variable is Receptivity

2. **What is(are) your independent variable(s)?**

The independent variable is PickUp (Cute-Direct = 1, Direct-Direct =2)

3. **Is there independence of observations?**

They are 2 independent groups, (Cute-Direct, experimental condition = 1, Direct-Direct, control condition =2)

I also conduct Durbin-Watson. The value 1.86 indicates that there is independence of observations.

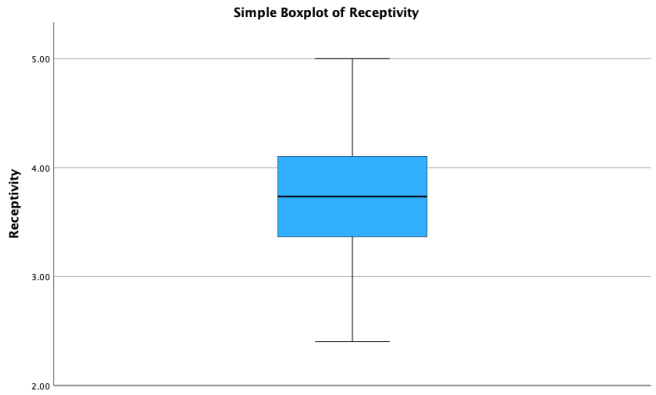
Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin–Watson
1	.192[a]	.037	.032	.52244	1.864

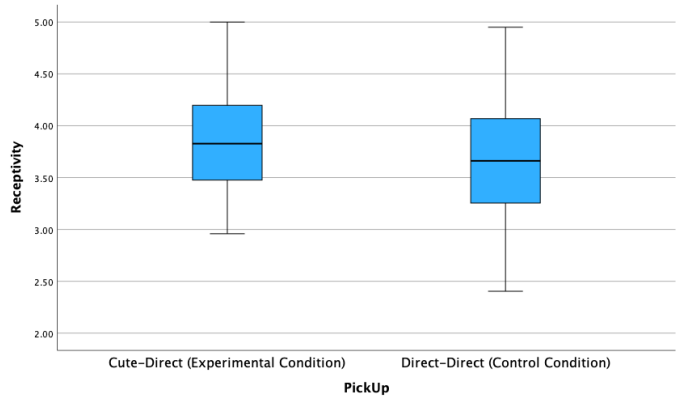
a. Predictors: (Constant), PickUp
b. Dependent Variable: Receptivity

4. **Are there any significant outliers?**

I don't find any significant outliers for Receptivity



There are no outliers if we split the groups for the variable PickUp



5. How is your dependent variable distributed in each cell?

I conduct a normality test and I see that the values in Cute-Direct are not normally distributed (very low value in significance), I use a non-parametric test.

The cell is all the values of the dependent variable that fall under one level of the factor
The levels of factor are the groups that make the independent variable (cells).

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	PickUp	Statistic	df	Sig.	Statistic	df	Sig.
Receptivity	Cute-Direct (Experimental Condition)	.102	120	.004	.958	120	<.001
	Direct-Direct (Control Condition)	.072	74	.200*	.991	74	.871

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

6. Do you need to perform any transformations?

Yes, I transformed the PickUp variable to nominal, because I cannot conduct the non-parametric test with the PickUp variable as continuous.

The significance value in the non-parametric test is 0.017, there is significance and I reject the null hypothesis. Meaning that the distribution of Receptivity is different across the categories of PickUp.

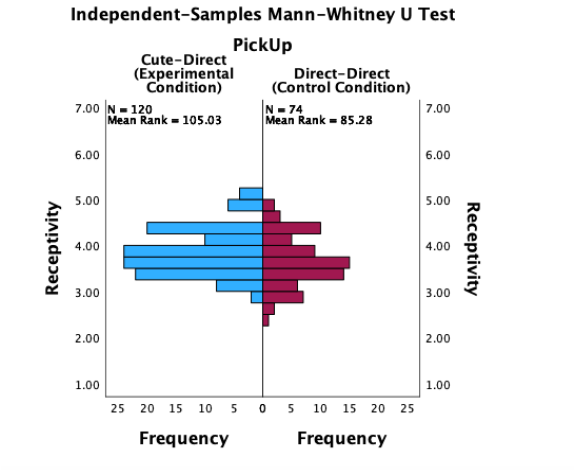
Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The distribution of Receptivity is the same across categories of PickUp.	Independent-Samples Mann-Whitney U Test	.017	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

I also see that the shape of the distributions is different. The variables are different in distribution.



7. Is there homogeneity or heterogeneity of variance?

Although the values for Cute-Direct are not normally distributed, I use Levene's test in One-Way ANOVA to calculate the homogeneity.

The homogeneity based on the mean (0.282) and based on median (0.281) are above 0.05, there is homogeneity, according to One-Way ANOVA.

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Receptivity	Based on Mean	1.166	1	192	.282
	Based on Median	1.171	1	192	.281
	Based on Median and with adjusted df	1.171	1	190.153	.281
	Based on trimmed mean	1.192	1	192	.276

8. **What is the mean score of receptivity in the experimental condition?**

The mean score of receptivity in the experimental condition is 3.86 score in receptivity

Receptivity

	N	Mean
Cute-Direct (Experimental Condition)	120	3.8634
Direct-Direct (Control Condition)	74	3.6545

9. **What is the mean score of receptivity in the control condition?**

The mean score of receptivity in the control condition is 3.65 score in receptivity

10. **What is your answer to RQ1? Report on the findings (no less than 150 words). Don't forget to mention the assumptions.**

A non-parametric test was conducted to determine if the level relationship receptivity was different for the 2 PickUp groups (Cute-Direct pick-up approach and Direct-Direct approach). Participants were classified into 2 groups of PickUp (Cute-Direct = 1, Direct-Direct =2). There were no outliers, as assessed by boxplot; there is independence of observations (between the 2 PickUp groups). Data is normally distributed for the Direct-Direct group (p-value = 0.871) and not normally distributed for the Cute-Direct group, as assessed by Shapiro-Wilk test (p-value obtained = <.001), hence I used the non-parametric test, because the p–value obtained in the normality test indicates that the data in Cute-Direct group is very non normal. There was homogeneity of variances as assessed by Levene's test of homogeneity of variances (p = 0.282).

The significance value in the non parametric test is 0.017, there is significance, which means that the distribution of Receptivity for Cute-Direct group is different than for Direct-Direct group.

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

Yes, there is evidence to suggest that the presence of androstadienone spray will lead to more relationship receptivity than no spray.

The Welch ANOVA test is statistically significant (p = 0.034), it can be concluded that one group's mean is different to the other group's mean. I also confirm in the Means Plot that the Receptivity is better when people use Spray rather than No Spray. In conclusion, there is statistically significant evidence to affirm that the presence of spray will lead to more relationship receptivity than no spray.

11. **What is your dependent variable?**

Receptivity

12. **What is(are) your independent variable(s)?**

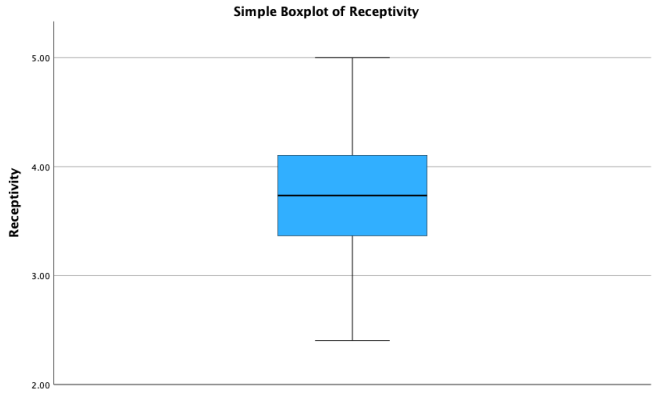
Scent is the independent variable (1: Spray, 2:No Spray)

13. **Is there independence of observations?**

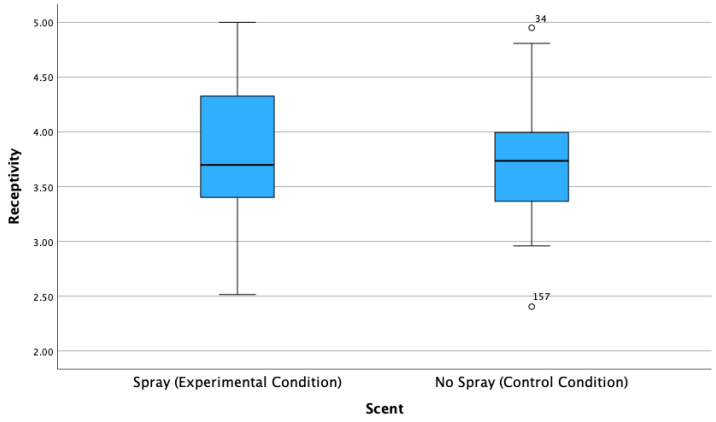
Yes there is independence of observations, they are 2 different groups (1: Spray Experimental Condition, 2:No Spray, Control Condition)

14. Are there any significant outliers?

I don't find any significant outliers for Receptivity



There are 2 outliers in the No Spray group, but these are not significant outliers.
We only consider significant the outliers above 3 standard deviations from the mean.



15. How is your dependent variable distributed in each cell?

The dependent variable is not normally distributed in both groups (Spray, No Spray). However, the significance value in Shapiro-Wilk is not very low, hence I can use One-Way ANOVA. Given the fact that only strong violations of normality require a non-parametric test.

Tests of Normality

	Scent	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Receptivity	Spray (Experimental Condition)	.114	104	.002	.974	104	.036
	No Spray (Control Condition)	.094	90	.048	.970	90	.036

a. Lilliefors Significance Correction

16. Do you need to perform any transformations?

Yes, I transformed the Scent variable to nominal, because it's a categorical variable.

17. Is there homogeneity or heterogeneity of variance?

There is heterogeneity of variance (significance = <.001), and the sample sizes are equal.

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Receptivity	Based on Mean	15.814	1	192	<.001
	Based on Median	12.753	1	192	<.001
	Based on Median and with adjusted df	12.753	1	169.624	<.001
	Based on trimmed mean	15.758	1	192	<.001

Given the fact I have heterogeneity, I look at the Welch's ANOVA table. The Welch ANOVA is statistically significant (p = 0.034), it can be concluded that at least one group's mean is different to another group's mean.

Robust Tests of Equality of Means

Receptivity

	Statistic[a]	df1	df2	Sig.
Welch	4.553	1	184.031	.034

a. Asymptotically F distributed.

Since I have heterogeneity of variance, I choose Games-Howell as the post hoc test.

I also check the effect sizes in ANOVA, Eta-squared = .022 (small), and Omega-squared = .017 (small).

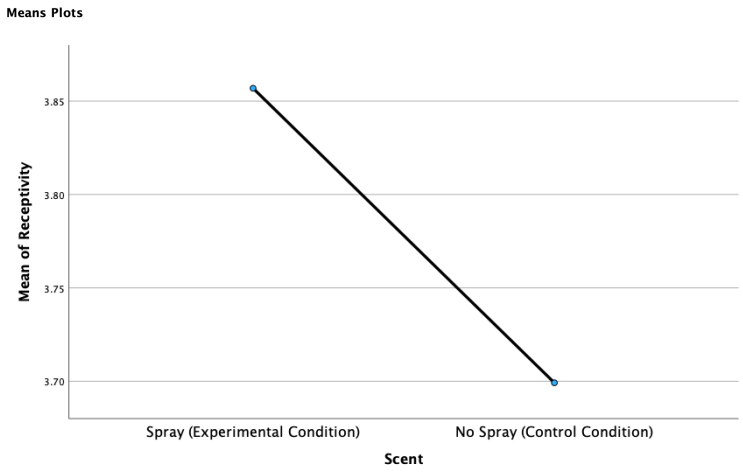
ANOVA Effect Sizes[a,b]

		Point Estimate	95% Confidence Interval Lower	Upper
Receptivity	Eta-squared	.022	.000	.078
	Epsilon-squared	.017	-.005	.073
	Omega-squared Fixed-effect	.017	-.005	.073
	Omega-squared Random-effect	.017	-.005	.073

a. Eta-squared and Epsilon-squared are estimated based on the fixed-effect model.

b. Negative but less biased estimates are retained, not rounded to zero.

If I check the Means Plot, I see that the Receptivity is better when people use Spray rather than No Spray.



18. What is the mean score of receptivity in the experimental condition?

The mean score of receptivity in the experimental condition is 3.85

Receptivity

	N	Mean
Spray (Experimental Condition)	104	3.8569
No Spray (Control Condition)	90	3.6992
Total	194	3.7837

19. What is the mean score of receptivity in the control condition?

The mean score of receptivity in the control condition is 3.70

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 determine if the level relationship receptivity was different for 2 different groups (1: Spray experimental condition and 2:No Spray control condition). There were 2 outliers in the No Spray group as assessed by boxplot, however these are not significant outliers. There is independence of observations, they are 2 different groups (1: Spray Experimental Condition, 2:No Spray, Control Condition). Data was not normally distributed for each group (p-value obtained in each group = 0.036) as assessed by Shapiro-Wilk, however the significance value in Shapiro-Wilk is not very low, hence I use One-Way ANOVA. There wasn't homogeneity of variances, as assessed by Levene's test of homogeneity of variances (p-value obtained = <.001)**.** The Receptivity was statistically significantly different between the 2 Scent groups, F(1, 184.031) = 4.553, p = .034.
Mean for Receptivity-Spray = 3.85 (SD = .60), mean for Receptivity-No Spray = 3.70 (SD = .42). Eta-squared (η2) = .022 (small),and Omega-squared (ω2) = .017 (small).

The Welch ANOVA is statistically significant (p = 0.034) , it can be concluded that at least one group's mean is different to another group's mean. According to the values in the Means Plot, the Receptivity mean increases when people use Spray rather than No Spray, there is a

statistically significant difference of means between the 2 groups (1: Spray experimental condition and 2:No Spray control condition).

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?

Yes, there is statistically evidence to suggest that the impact of the androstadienone spray on attractiveness effect will be enhanced by the Cute-Direct pick-up approach.
The Cute-Direct group has better Receptivity results when they use spray.

21. What is your dependent variable?

Receptivity (attractiveness effect)

22. What is(are) your independent variable(s)?

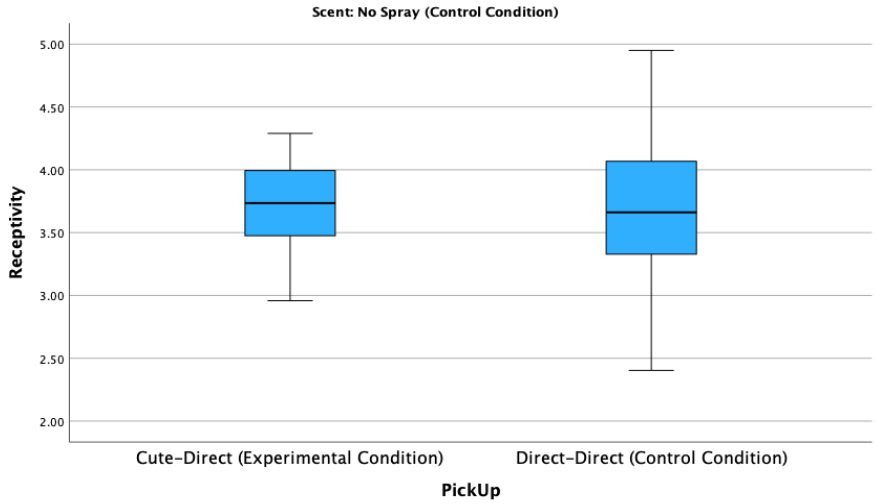
PickUp (Cute-Direct = 1, Direct-Direct =2) and Scent (1: Spray, 2:No Spray)

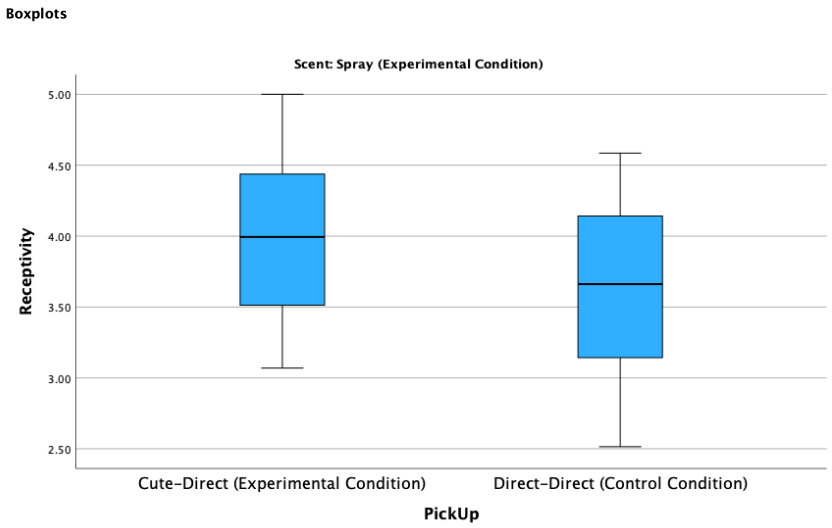
23. Is there independence of observations?

Yes, there is independence of observations, because the variables PickUp and Scent divide the sample into different groups, 2 groups for PickUp and another 2 groups for Scent.

24. Are there any significant outliers?

There are no significant outliers





25. How is your dependent variable distributed in each cell?

All the groups are normally distributed, except Spray-Cute-Direct (significance = .011). I can proceed with the Two-Way ANOVA because the non normal data in the group Spray-Cute-Direct is not very low. Given the fact that only strong violations of normality require a non-parametric test.
Spray-Direct-Direct (significance = .120), No Spray-Cute-Direct (significance = .062) and No-Spray-Direct-Direct (significance = .435).

Tests of Normality

			Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Scent		PickUp	Statistic	df	Sig.	Statistic	df	Sig.
Spray (Experimental Condition)	Receptivity	Cute-Direct (Experimental Condition)	.124	60	.022	.947	60	.011
		Direct-Direct (Control Condition)	.122	44	.096	.959	44	.120
No Spray (Control Condition)	Receptivity	Cute-Direct (Experimental Condition)	.126	60	.020	.962	60	.062
		Direct-Direct (Control Condition)	.110	30	.200*	.966	30	.435

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

26. Do you need to perform any transformations?

Yes, I divided everything by Scent (Spray and No Spray), in order to check the normality for the dependent variable in each cell, Receptivity as dependent and PickUp as the independent variable.

27. Is there homogeneity or heterogeneity of variance?

There is heterogeneity of variance (significance = <.001), and the sample sizes are equal

Levene's Test of Equality of Error Variances[a,b]

		Levene Statistic	df1	df2	Sig.
Receptivity	Based on Mean	5.837	3	190	<.001
	Based on Median	5.529	3	190	.001
	Based on Median and with adjusted df	5.529	3	162.170	.001
	Based on trimmed mean	5.830	3	190	<.001

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Receptivity

b. Design: Intercept + PickUp + Scent + PickUp * Scent

The ratio of the largest group variance to the smallest group variance is less than 3, which means that I can use the Two-Way ANOVA.
In this particular case, the Two-Way ANOVA test is robust to the heterogeneity.
I choose the Bonferroni post hoc test.

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?

There is interaction between the two factors because there is statistically significance (.003) for PickUp*Scent

Tests of Between-Subjects Effects

Dependent Variable: Receptivity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5.844[a]	3	1.948	7.621	<.001	.107
Intercept	2535.858	1	2535.858	9921.823	<.001	.981
PickUp	1.768	1	1.768	6.916	.009	.035
Scent	.644	1	.644	2.520	.114	.013
PickUp * Scent	2.329	1	2.329	9.113	.003	.046
Error	48.561	190	.256			
Total	2831.811	194				
Corrected Total	54.405	193				

a. R Squared = .107 (Adjusted R Squared = .093)

I analyze the pairwise comparisons by Scent and by PickUp.
I found statistically significant mean difference for Spray-Cute-Direct and Spray-Direct-Direct groups (<.001).

Pairwise Comparisons

Dependent Variable: Receptivity

Scent	(I) PickUp	(J) PickUp	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Spray (Experimental Condition)	Cute-Direct (Experimental Condition)	Direct-Direct (Control Condition)	.427*	.100	<.001	.229	.625
	Direct-Direct (Control Condition)	Cute-Direct (Experimental Condition)	-.427*	.100	<.001	-.625	-.229
No Spray (Control Condition)	Cute-Direct (Experimental Condition)	Direct-Direct (Control Condition)	-.029	.113	.795	-.252	.194
	Direct-Direct (Control Condition)	Cute-Direct (Experimental Condition)	.029	.113	.795	-.194	.252

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

There is also statistically significant mean difference for Cute-Direct-Spray and Cute-Direct-No Spray groups (<.001).

Pairwise Comparisons

Dependent Variable: Receptivity

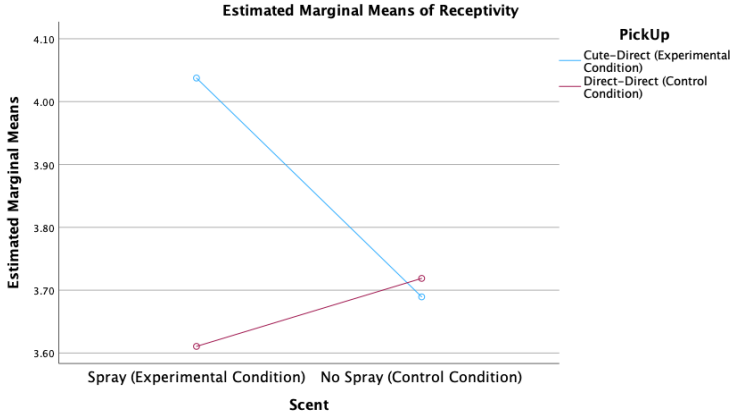
PickUp	(I) Scent	(J) Scent	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Cute-Direct (Experimental Condition)	Spray (Experimental Condition)	No Spray (Control Condition)	.348*	.092	<.001	.166	.530
	No Spray (Control Condition)	Spray (Experimental Condition)	-.348*	.092	<.001	-.530	-.166
Direct-Direct (Control Condition)	Spray (Experimental Condition)	No Spray (Control Condition)	-.108	.120	.367	-.344	.128
	No Spray (Control Condition)	Spray (Experimental Condition)	.108	.120	.367	-.128	.344

Based on estimated marginal means

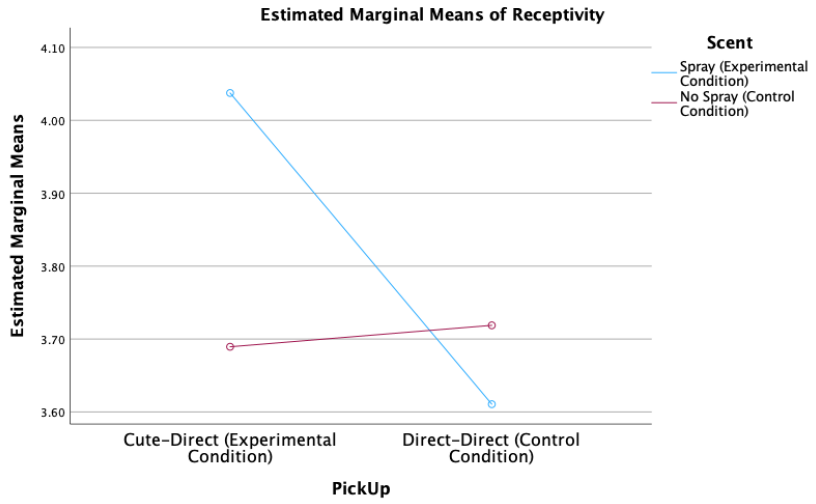
*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

There is better Receptivity when people of the Cute-Direct group use Spray, and worse Receptivity when the people of the Cute-Direct group don't use Spray. This means that there is a statistically significant mean difference if the Cute-Direct group use Spray or not.
There is worse Receptivity when people of the Direct-Direct group use Spray (better results with No Spray).



There is a statistically significant mean difference between Spray-Cute-Direct group and Spray-Direct-Direct group.



In conclusion, I find statistically significant evidence to confirm that the use of spray in the Cute-Direct group improves the Receptivity.

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 test was conducted to examine the effects of the variables PickUp and Scent in the Receptivity. 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, residuals were normally distributed (p >.05), and there was heterogeneity of variances (p = <.001), I proceeded with the Two-Way ANOVA test, because is robust to this particular heterogeneity.
The samples sizes were equal.

There was a statistically significant interaction between PickUp and Scent on Receptivity, *F(1, 190)* = 9.113, p = .003, partial η^2 = .046 (small effect size).
Regarding the One-Way ANOVA, there was significance in PickUp, p= .009, η^2 = .035 (small effect size) and no significance in Scent, p = .114, η^2 = .013 (small effect size).

All pairwise comparisons were run for each simple main effect with reported 95% confidence intervals and *p-values* Bonferroni-adjusted within each simple main effect. The mean for Cute-Direct with Spray was 4.037 (SD = .56), mean for Cute-Direct with No Spray was 3.68 (SD = .34), mean for Direct-Direct with Spray was 3.61 (SD = .56) and mean for Direct-Direct No Spray was 3.71 (SD = .55).
There was found statistically significant mean difference for Spray-Cute-Direct and Spray-Direct-Direct groups (p= <.001). There was also found statistically significant mean difference for Cute-Direct-Spray and Cute-Direct-No Spray groups (p= <.001).

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.

I find statistically significant evidence to confirm that the Cute-Direct pick-up group that uses Spray, have higher values in the Receptivity during the relationship initiation. Meaning that the Cute-Direct pick-up group with Spray have a positive effect on the Receptivity.

The non-parametric test confirms that there is statistically significant evidence difference between the Cute-Direct group and the Direct-Direct group in the Receptivity.

The Welch ANOVA test is statistically significant and confirms that there is evidence to suggest that the presence of androstadienone spray will lead to more relationship receptivity than no spray. Receptivity is better when people use Spray rather than No Spray.

I conduct a Two-Way ANOVA test, and I find statistically evidence to suggest that the impact of the androstadienone spray on attractiveness effect will be enhanced by the Cute-Direct pick-up approach. This means that if the Cute-Direct group uses spray, the Receptivity improves.

Regarding the non-parametric test, I didn't find significant outliers, there is independence of observations, the data is continuous, the values in Cute-Direct are not normally distributed and there is homogeneity of variance (One-Way ANOVA). For the Welch ANOVA test, there are 2 outliers in the No Spray group (not significant outliers), there is independence of observations and the data is continuous. The dependent variable is not normally distributed in both groups (Spray, No Spray). However, the significance value in Shapiro-Wilk is not very low, hence I use One-Way ANOVA. There is heterogeneity of variance of the dependent variable.

For the Two-Way ANOVA, there are no significant outliers, there is independence of observations, the data is continuous, all the groups of the dependent variable are normally distributed, except Spray-Cute-Direct (significance = .011), and there is heterogeneity of variance between groups.