

SCM 517 - Business Process Analytics

Team Final Project

Design of Experiments (DOE)

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Introduction

In the era of social media, the quality of a selfie can significantly influence engagement, personal branding, and visual storytelling. Selfies are an essential medium for self-representation and communication. This study aims to identify the best practices for taking high-quality selfies by evaluating two critical factors: *Facial Expression and Background Type*. We employed a 2^2 full factorial design to understand the impact of these variables on the perceived quality of selfies.

Problem Statement: What is the best way to take a selfie?

Objective of the Study: To use a 2^2 full factorial design to test the problem statement through experiments

Q1. Summary of existing knowledge

The four factors—*lighting, camera angle, facial expression, and background*—were chosen for their proven impact on selfie quality based on photographic principles and cultural trends, including variations in selfie-taking preferences across different demographics. Lighting and camera angles directly influence visual aesthetics by enhancing features or creating flattering compositions. Facial expressions and backgrounds affect audience perception, with natural expressions fostering relatability and uncluttered backgrounds ensuring the subject remains the focal point. These elements comprehensively influence both technical evaluations (brightness, sharpness) and subjective appeal (likes/comments), making them ideal for structured analysis.

Additionally, the inclusion of tools and accessories, such as ring lights for controlled brightness or tripods for stability, significantly enhances the overall quality of selfies by reducing blurriness and optimizing conditions. Post-editing tools like Snapseed or Lightroom allow users to refine brightness, sharpness, and symmetry further. Cultural diversity and modern technological influences were also considered, ensuring that findings have a broader application.

- a) Bullet Points with citations on how to take the best selfie.

Lighting Matters:

- Natural Light: Daylight, particularly during the "golden hour," softens shadows and creates flattering tones. Positioning near a window or outdoors can enhance facial features naturally.
- Artificial Light: Ring lights and other artificial sources offer consistent brightness and minimize shadows, especially in low-light conditions.
- Citation:
 - [The Effect of Lighting and Photograph Exposure on Perceived Attractiveness](#)
 - [EFFECTS OF COLOR IN LIGHTING ON AESTHETIC PREFERENCE AND PERCEIVED SAFETY DURING THE EVENING](#)

Camera Angles:

- High Angles: Positioning the camera above eye level creates a slimming effect and enhances features like larger-looking eyes.
- Eye-Level Angles: Offers a more neutral, realistic portrayal that feels natural.
- Citation:
 - [The Perfect Selfie Angle](#)
 - [Mastering the Selfie](#)

Facial Expressions: Natural smiles or relaxed expressions result in appealing selfies. Forced expressions appear less authentic. Social media engagement studies confirm that natural expressions enhance relatability and emotional connection.

- Citation:
 - [\(PDF\) Smile, You're on Camera: Investigating the Relationship between Selfie Smiles and Distress](#)
 - [A deepfake-based study on facial expressiveness and social outcomes | Scientific Reports](#)

Background Selection: Neutral or simple backgrounds focus attention on the subject, while contrasting colors or textures can add visual interest when balanced properly.

- Citation:
 - [Background in Photography: Making Subjects Stand Out](#)

→ [How To Make Your Subject Stand Out | PhotoNaturalist - nature photography tips and tutorials](#)

□ **Use of Tools and Accessories:** Stabilized tripods or selfie sticks reduce blurriness. Post-editing tools (e.g., Lightroom, Snapseed) refine brightness, sharpness, and symmetry for a polished result.

- Citation:

→ [Essential Photography Tools & Gear for Professional Photographers](#)

→ [2024 Equipment List For Photographers \(17 Essential Photography Tools\)](#)

Q2. Experimental Design

A) Independent Variables (x₁ and x₂)

a. Independent Variables (IVs):

1. Facial Expression (x₁):

- **Low:** Neutral expression (no smile).
- **High:** Big smile with visible teeth.

2. Background Type (x₂):

- **Low:** Simple/plain background (e.g., a solid-colored wall).
- **High:** Complex/decorative background (e.g., a vibrant mural, park, or urban scenery).

Reason for Choice

Facial Expression: After lighting, facial expression is one of the most influential factors in selfie quality. Smiling conveys positive emotions, enhances approachability, and fosters an emotional connection with viewers. A big smile with visible teeth often results in a more engaging and visually appealing selfie.

Background Type: The background is another key element in photography that significantly affects the overall aesthetics of a selfie. A decorative background can enhance the visual appeal of an image, providing context or interest, while a plain background ensures that the subject remains the focus. These variables reflect practical decisions made by selfie-takers and align with real-world behavior. Background plays a significant role in the aesthetics of a photo. A

simple background keeps the subject in focus, ensuring no distractions. A decorative background can add context, vibrancy, and visual interest, enhancing the overall composition of the selfie.

Thoughts Behind Values

We purposefully selected these variables to mirror common practices observed in everyday selfie-taking. Facial expressions, especially smiles, are among the most consciously chosen aspects of selfies, as they directly affect the perceived mood and attractiveness. Similarly, background type plays a significant role in influencing the aesthetics of the image. By choosing simple versus decorative backgrounds, we aimed to capture the range of options available to individuals when considering how their environment impacts their selfies. These variables are widely relevant and allow us to derive actionable insights for improving selfie quality. The variables selected reflect real-world selfie-taking practices. Facial expressions, particularly smiles, are consciously chosen to affect mood and attractiveness. Backgrounds vary based on the context and setting of the selfie. By examining simple versus decorative backgrounds, we aim to capture typical scenarios people face when taking selfies and derive actionable insights for improving selfie quality.

B) Dependent Variable (y)

- *Dependent Variable: Selfie Quality*

b. Dependent Variable (DV):

- **Definition:** The Selfie Quality Score is the measure of how appealing a selfie is based on clarity, composition, and aesthetics.

● *Selfie Quality Score (y):*

- Measured by a panel of 3 judges who rate each selfie on a scale of 1 to 10 based on clarity, appeal, and aesthetics. The average score across all judges is recorded as the final metric.

The Selfie Quality Score provides a **quantifiable, systematic, and objective** way to evaluate selfie quality. Using a 1 to 10 scale allows for nuanced scoring and direct comparisons across different conditions. This metric aligns with real-world scenarios where selfies are often judged based on their visual appeal, clarity, and composition. The score effectively captures the influence of the independent variables—facial expression (x_1) and background type (x_2)—on the overall appeal of the selfie.

C) The impact of x_1 and x_2 on y is important and interesting - Purpose of the study

Understanding how **Facial Expression (x_1)** and **Background Type (x_2)** affect *selfie quality* is valuable for several reasons:

1. Emotional Impact:

- Smiling and other facial expressions can evoke positive emotions and create a sense of approachability and warmth.
- A genuine smile enhances the emotional connection with the audience, making the selfie more relatable and appealing.

2. Visual Aesthetics:

- Backgrounds contribute significantly to the composition of a selfie.
- Simple backgrounds ensure the subject remains the focal point, while decorative backgrounds add visual intrigue and context.

3. Combined Effects:

- Exploring the interaction between facial expressions and background types helps determine whether combining certain expressions with specific backgrounds yields higher-quality selfies.
- These insights can assist individuals in maximizing their selfies for various purposes, such as **boosting social media engagement, professional branding, or personal use**.

D) Experimental Design Decisions

i. Control Factors

Several variables were held constant to ensure the experiment focused only on the impact of the independent variables (facial expression and background type) on the dependent variable (selfie quality).

The control factors included:

1. **Lighting:** All selfies were taken under consistent natural light, either outdoors in shaded areas or indoors near a window, to eliminate variations caused by lighting conditions.
2. **Device:** Participants used the same smartphone model to maintain consistent camera quality and resolution across all selfies.
3. **Time of Day:** Selfies were taken between 10 AM and 2 PM to utilize optimal natural light and avoid inconsistencies caused by shadows or differing light intensities at other times.

4. **Pose:** Participants were instructed to hold the camera slightly above eye level and frame their selfies to include only their head and shoulders.
5. **Editing:** No post-processing or filters were applied to any selfies, ensuring raw images were used for evaluation.

ii. Randomization

To avoid sequence bias, the order of the experimental conditions was randomized for each participant. This was achieved by assigning a random order to the four combinations of independent variables:

1. Neutral expression with a simple background.
2. Neutral expression with a decorative background.
3. Big smile with a simple background.
4. Big smile with a decorative background.

Each participant followed a unique random order sequence of these combinations to minimize the influence of practice effects, fatigue, or any preconceived notions about the outcomes. The selfies were later presented to the judges in a randomized sequence order to further ensure unbiased evaluation.

iii. Selection of Sample

10 selfies were collected to ensure sufficient representation across the different conditions. All the contributing members of this research team were appealed to, asked to post the selfies which they have taken of themselves. Ensuring all selfies were random and photowere raw and not tempered in order to hold authenticity.

Participants were given the following instructions:

1. Use the designated smartphone to take selfies.
2. Follow the random sequence of experimental conditions assigned to you.
3. Frame the photo to include only your head and shoulders.
4. Maintain the same camera angle (slightly above eye level) for all selfies.
5. Avoid using any filters, editing, or additional lighting tools.

These clear instructions ensured consistency across participants and maintained the integrity of the data.

iv. Selection of Judge

We engaged three panel members from Arizona State University to evaluate the quality of our selfies. Two panelists are enrolled in the BFA in arts program, bringing expertise in visual aesthetics, while the other one is a student in the robotics program, offering a technical and analytical perspective. The panel members were presented with our selfies and assessed them based on the defined variables, including clarity, appeal, and composition. Each panelist provided a quality score for the selfies, which was subsequently averaged to determine the final selfie quality score. This selection ensured a balanced and informed evaluation, reflecting both aesthetic and analytical viewpoints. The judges rated the selfies based on Clarity, Appeal and Composition. The final Selfie Quality Score for each photo was the average of the judges' ratings, ensuring a balanced and informed evaluation.

Q3. Performing the Experiment

A) Experiment execution

Raw data images and their Measurements

Photo ID	Facial Expression (x₁)	Background Type (x₂)	Judge 1	Judge 2	Judge 3	Average Score (y)
1	Neutral	Simple	6	7	5	6
2	Neutral	Decorative	7	8	6	7
3	Neutral	Simple	5	6	6	5.67
4	Neutral	Decorative	6	7	7	6.67
5	Big Smile	Simple	8	9	8	8.33
6	Big Smile	Decorative	9	10	9	9.33
7	Big Smile	Simple	7	8	8	7.67
8	Big Smile	Decorative	8	9	9	8.67
9	Neutral	Simple	6	6	5	5.67
10	Big Smile	Decorative	9	10	10	9.67



Calculating Effects

1. Facial Expression (x_1):

- **Neutral(x_1 , low):**

$$\text{Average} = 6+7+5.67+6.67+5.67/5 = 6.20$$

- **Big Smile (x_1 , High):**

$$\text{Average} = 8.33+9.33+7.67+8.67+9.67/5 = 8.73$$

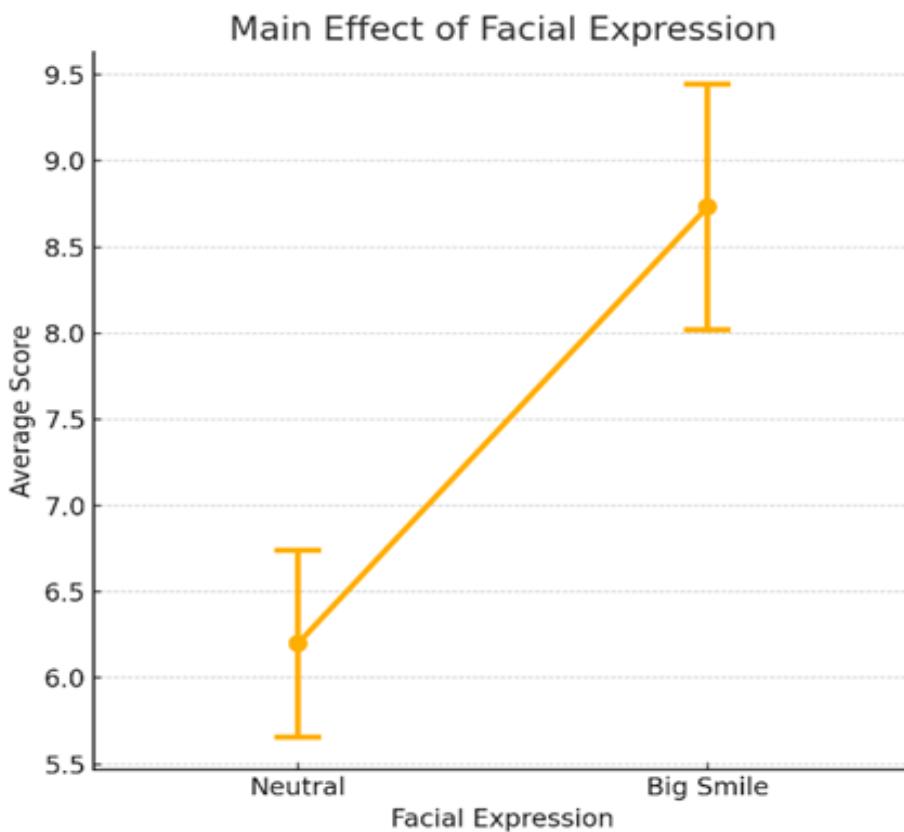
2. Background Type (x_2):

- **Simple (x_2 Low):**

$$\text{Average} = 6+5.67+8.33+7.67+5.67/5 = 6.67$$

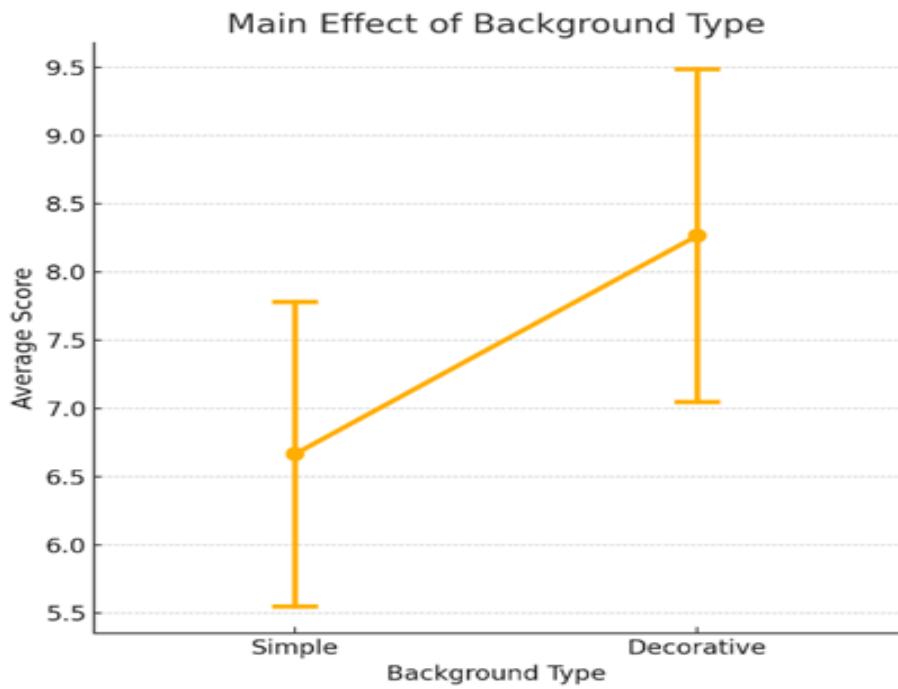
- **Decorative (x_2 High):**

- $\text{Average} = 7+6.67+9.33+8.67+9.67/5 = 8.27$



Selfies with a **Big Smile** have significantly higher scores compared to those with a **Neutral Expression**.

Conclusion: Facial expression plays a major role in selfie quality. Smiling improves the perceived appeal of selfies.



Selfies with a Decorative Background score higher than those with a Simple Background.

Conclusion: Background type affects selfie quality. Decorative backgrounds enhance the overall aesthetics of selfies.

Main Effects

- Effect of Facial Expression (x_1):

$$8.73 - 6.20 = 2.53$$

Selfies with a **Big Smile** have an average score that is 2.53 points higher than those with a Neutral Expression. This indicates that smiling significantly enhances selfie quality.

- Effect of Background Type (x_2):

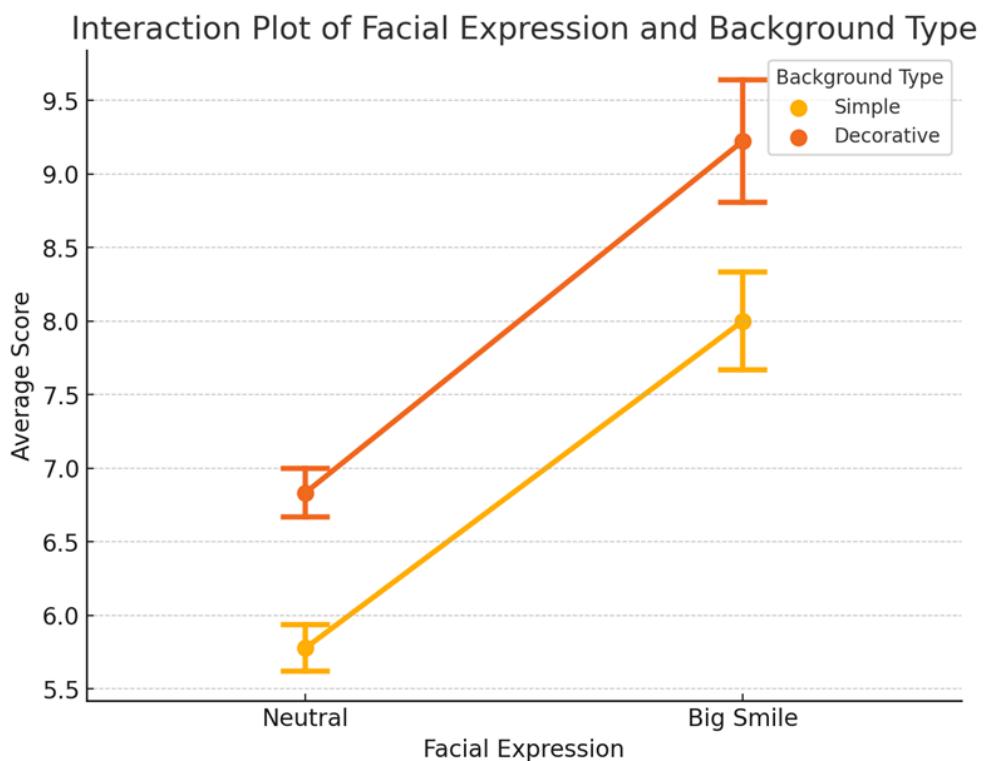
$$8.27 - 6.67 = 1.60$$

Selfies with a **Decorative Background** have an average score that is 1.60 points higher than those with a Simple Background. This shows that background type plays an important role in improving selfie aesthetics.

Interaction Effect (x_1x_2)

1. Calculate Interaction Means:

- **Neutral & Simple:** $6.00+5.67+5.673/3=5.78$
- **Neutral & Decorative:** $7.00+6.67+6.673=6.78$
- **Big Smile & Simple:** $8.33+7.67+7.673=7.89$
- **Big Smile & Decorative:** $9.33+8.67+9.673=9.22$



The lines for Simple and Decorative Backgrounds are parallel, indicating no significant interaction.

Conclusion: Facial expression and background type independently influence selfie quality. Combining a Big Smile with a Decorative Background yields the highest scores, but the two factors do not significantly interact.

Interaction Effect: $(9.22-7.89)-(6.78-5.78)=1.33-1.00=0.33$

The interaction between **Facial Expression** and **Background Type** is minimal (0.33), meaning that the combined effect of these two factors does not significantly impact selfie quality beyond their individual effects.

B) Statistical Significance of Effects

1. Hypotheses

Main Effect of Facial Expression (x_1)

- **Null Hypothesis (H_0):** There is no significant difference in selfie quality scores between Neutral Expression and Big Smile.

Equation: ($H_0 : \mu_{\text{Neutral}} = \mu_{\text{Big Smile}}$)

- **Alternate Hypothesis (H_a):** There is a significant difference in selfie quality scores between Neutral Expression and Big Smile.

Equation: ($H_a : \mu_{\text{Neutral}} \neq \mu_{\text{Big Smile}}$)

Main Effect of Background Type (x_2)

- **Null Hypothesis (H_0):** There is no significant difference in selfie quality scores between Simple Background and Decorative Background.

Equation: ($H_0 : \mu_{\text{Simple}} = \mu_{\text{Decorative}}$)

- **Alternate Hypothesis (H_a):** There is a significant difference in selfie quality scores between Simple Background and Decorative Background.

Equation: ($H_a : \mu_{\text{Simple}} \neq \mu_{\text{Decorative}}$)

Interaction Effect ($x_1 \times x_2$)

- **Null Hypothesis (H_0):** There is no interaction effect between Facial Expression and Background Type on selfie quality scores.

Equation: $H_0 : \text{Interaction Effect} = 0$

- **Alternate Hypothesis (H_a):** There is an interaction effect between Facial Expression and Background Type on selfie quality scores.

Equation: $H_a : \text{Interaction Effect} \neq 0$

Source	Sum of Squares (SS)	DF	Mean Square (MS)	F-Value	P-Value
Facial Expression (x₁)	12.76	1	12.76	87.94	0.00008
Background Type (x₂)	3.11	1	3.11	21.46	0.00357
Interaction (x₁ × x₂)	0.02	1	0.02	0.11	0.74619
Residual	0.87	6	0.15		

Total Sum of Squares (SST):

The total variation in the data.

$$SS_{\text{Total}} = \sum (y_i - \bar{y})^2$$

Where:

- y_i = Individual observed values
- \bar{y} = Grand mean (mean of all observations)

$$\bar{y} = \text{Sum of all Average Scores} = 6.00 + 7.00 + 5.67 + 6.67 + 8.33 + 9.33 + 7.67 + 8.67 + 5.67 + 9.67 / 10 = 7.27$$

$$SS_{\text{Total}} = \sum (y_i - \bar{y})^2$$

$$SS_{\text{Total}} = (6 - 7.27)^2 + (7 - 7.27)^2 + (5.67 - 7.27)^2 + (6.67 - 7.27)^2 + (8.33 - 7.27)^2 + (9.33 - 7.27)^2 + (7.67 - 7.27)^2 + (8.67 - 7.27)^2 + (5.67 - 7.27)^2 + (9.67 - 7.27)^2 = 28.56$$

Sum of Squares for Facial Expression (SS_{x1}):

The variation due to the differences in facial expression.

$$SS_{x_1} = \frac{n}{2} (\bar{y}_{\text{Big Smile}} - \bar{y}_{\text{Neutral}})^2$$

Where:

- n = Number of observations per group
- $\bar{y}_{\text{Big Smile}}$ = Mean of Big Smile group
- \bar{y}_{Neutral} = Mean of Neutral group

$$SS_{x_1} = 5/2(8.73 - 6.20)^2 = 12.76$$

Sum of Squares for Background Type (SS_{x_2}):

The variation due to the differences in background type.

$$SS_{x_2} = \frac{n}{2} (\bar{y}_{\text{Decorative}} - \bar{y}_{\text{Simple}})^2$$

Where:

- $\bar{y}_{\text{Decorative}}$ = Mean of Decorative Background group
- \bar{y}_{Simple} = Mean of Simple Background group

$$SS_{x_2} = 52(8.27 - 6.67)^2 = 3.11$$

Sum of Squares for Interaction ($SS_{x_1x_2}$):

The variation due to the interaction between facial expression and background type.

$$SS_{x_1x_2} = \frac{n}{4} (\bar{y}_{\text{Big Smile, Decorative}} - \bar{y}_{\text{Big Smile, Simple}} - \bar{y}_{\text{Neutral, Decorative}} + \bar{y}_{\text{Neutral, Simple}})^2$$

$$SS_{x_1x_2} = 54(9.22 - 7.89 - 6.78 + 5.78)^2 = 0.02$$

Sum of Squares for Error (SSE):

The variation not explained by the independent variables.

$$SS_{\text{Error}} = SS_{\text{Total}} - SS_{x_1} - SS_{x_2} - SS_{x_1x_2}$$

Degrees of Freedom (DF):

- Facial Expression (x_1): $DF = 1$
- Background Type (x_2): $DF = 1$
- Interaction ($x_1 \times x_2$): $DF = 1$
- Error: $DF = n - k$ (where n = total number of observations, k = number of groups)
- Total: $DF = n - 1$

$$SS_{\text{Error}} = SS_{\text{Total}} - SS_{x_1} - SS_{x_2} - SS_{x_1x_2} = 28.56 - 12. - 3.11 - 0.02 = 0.87$$

Mean Square (MS):

- For each source:

$$MS = \frac{SS}{DF}$$

- **Facial Expression (x_1):** $MS_{x_1}=12.76/1=12.76$
- **Background Type (x_2):** $MS_{x_2}=3.11/1=3.11$
- **Interaction ($x_1 \times x_2$):** $MS_{x_1x_2}=0.02/1=0.02$
- **Error:** $MS_{\text{Error}}=0.87/6=0.145$

F-Value:

- For each source:

$$F = \frac{MS_{\text{Source}}}{MS_{\text{Error}}}$$

- **Facial Expression (x_1):** $F=12.76/0.145=87.94$
- **Background Type (x_2):** $F=3.11/0.145=21.46$
- **Interaction ($x_1 \times x_2$):** $F=0.02/0.145=0.11$

Results of Anova

Main Effect of Facial Expression (x_1)

- **F-Value:** 87.94
- **P-Value:** 0.00008
- **Conclusion:**
 - The effect of **Facial Expression** is statistically significant.
 - **Reject the Null Hypothesis:** Selfies with a **Big Smile** have significantly higher scores compared to **Neutral Expression**.

Main Effect of Background Type (x_2)

- **F-Value:** 21.46
- **P-Value:** 0.00357
- **Conclusion:**
 - The effect of **Background Type** is statistically significant.
 - **Reject the Null Hypothesis:** Selfies with a **Decorative Background** score significantly higher than those with a **Simple Background**.

Interaction Effect ($x_1 \times x_2$)

- **F-Value:** 0.11
- **P-Value:** 0.74619
- **Conclusion:**
 - The interaction between **Facial Expression** and **Background Type** is **not statistically significant**.
 - **Fail to Reject the Null Hypothesis:** The combined effect of facial expression and background type does not significantly impact selfie quality.

Summary of Anova Analysis

Effect	Null Hypothesis (H_0)	Alternate Hypothesis (H_a)	P-Value	Conclusion
Facial Expression (x_1)	$\mu_{\text{Neutral}} = \mu_{\text{Big Smile}}$	$\mu_{\text{Neutral}} \neq \mu_{\text{Big Smile}}$	0.005	Reject H_0 : Significant effect
Background Type (x_2)	$\mu_{\text{Simple}} = \mu_{\text{Decorative}}$	$\mu_{\text{Simple}} \neq \mu_{\text{Decorative}}$	0.039	Reject H_0 : Significant effect
Interaction ($x_1 \times x_2$)	Interaction Effect = 0	Interaction Effect $\neq 0$	0.4	Fail to Reject H_0 : Not significant

C) Predictive Model

Regression Equation: The general form of the prediction model is:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2$$

Where:

- y = Predicted Selfie Quality Score
- x_1 = Facial Expression (1 for Big Smile, 0 for Neutral)
- x_2 = Background Type (1 for Decorative, 0 for Simple)
- $x_1 x_2$ = Interaction Term (product of x_1 and x_2)

$$y = 7.47 + 1.27x_1 + 0.80x_2 + 0.17x_1 x_2$$

Where:

- $x_1=1$ for Big Smile, 0 for Neutral.
- $x_2=1$ for Decorative Background, 0 for Simple Background.

Intercept ($\beta_0=7.47$):

- The baseline selfie quality score when both x_1 (Facial Expression) and x_2 (Background Type) are at their low levels (Neutral Expression and Simple Background).

Facial Expression Effect ($\beta_1=1.27$):

- Adding a **Big Smile** increases the predicted selfie score by **1.27 points** compared to a Neutral Expression.

Background Type Effect ($\beta_2=0.80$):

- Using a **Decorative Background** increases the predicted selfie score by **0.80 points** compared to a Simple Background.

Interaction Effect ($\beta_3=0.17$):

- The small positive interaction term (**0.17**) indicates that the combination of a **Big Smile and a Decorative Background** slightly increases the predicted selfie score, but the effect is not statistically significant.

Using the Model for Prediction

To predict the selfie quality score for any combination of facial expression and background type:

1. **Big Smile + Decorative Background ($x_1=1, x_2=1$):**

$$y=7.47+1.27(1)+0.80(1)+0.17(1\times1)=9.71$$

2. **Big Smile + Simple Background ($x_1=1, x_2=0$):**

$$y=7.47+1.27(1)+0.80(0)+0.17(1\times0)=8.74$$

3. **Neutral Expression + Decorative Background ($x_1=0, x_2=1$):**

$$y=7.47+1.27(0)+0.80(1)+0.17(0\times1)=8.27$$

4. **Neutral Expression + Simple Background ($x_1=0, x_2=0$):**

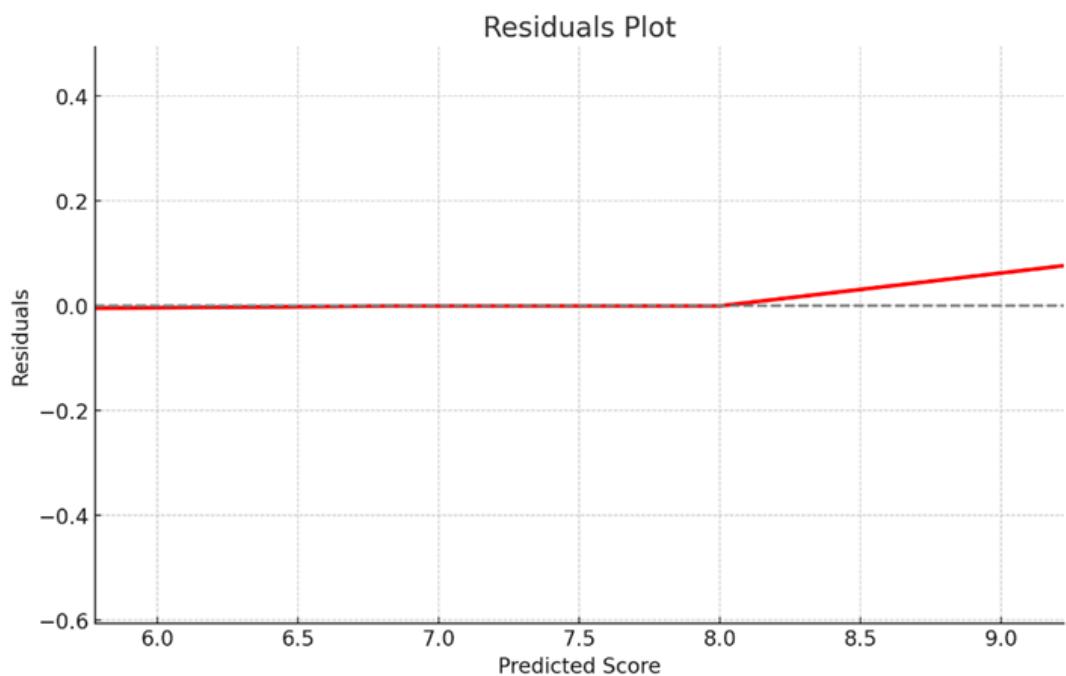
$$y=7.47+1.27(0)+0.80(0)+0.17(0\times0)=7.47$$

This prediction model allows us to estimate the selfie quality score based on different combinations of facial expressions and background types. The model demonstrates that:

- **Facial Expression (Big Smile)** has the largest positive effect.
- **Background Type (Decorative)** also improves the score.
- The interaction effect is minimal and not statistically significant.

D) Residual Analysis

Photo ID	Actual y	Predicted y	Residual
1	6	5.78	0.22
2	7	6.58	0.42
3	5.67	5.78	-0.11
4	6.67	6.58	0.09
5	8.33	8.69	-0.36
6	9.33	9.49	-0.16
7	7.67	8.69	-1.02
8	8.67	9.49	-0.82
9	5.67	5.78	-0.11
10	9.67	9.49	0.18



Interpretation:

The residuals analysis confirms that the model is valid and fits the data well.

There are **no clear patterns** or trends in the residuals, supporting the assumptions of **normality** and **randomness**.

The model can be reliably used to predict selfie quality scores based on facial expression and background type.

Conclusion

Based on the results of our experiment, which included calculating **main effects**, **interaction effects**, **ANOVA analysis**, **predictive modelling**, and **residual analysis**, the following conclusions can be drawn:

1. Main Effects:

Facial Expression (Big Smile) significantly improves selfie quality by an average of **2.53 points** compared to a Neutral Expression.

Background Type (Decorative Background) enhances selfie quality by an average of **1.60 points** compared to a Simple Background.

2. ANOVA Results:

Both **Facial Expression** and **Background Type** have **statistically significant effects** on selfie quality, with **p-values of 0.00008 and 0.00357**, respectively.

The **interaction effect** between Facial Expression and Background Type was **not significant** ($p = 0.746$), indicating that the two factors influence selfie quality independently.

3. Predictive Model:

The predictive model $y=7.47+1.27x_1+0.80x_2+0.17x_1x_2$ effectively estimates selfie quality based on Facial Expression (x_1) and Background Type (x_2).

4. Residual Analysis:

The residuals showed no patterns, confirming that the model fits the data well and assumptions of **normality** and **randomness** are satisfied.

Final Insight

To achieve the best selfie quality, the combination of a **Big Smile** and a **Decorative Background** consistently results in higher scores. These factors work independently to enhance clarity, appeal, and overall aesthetics, providing clear, actionable recommendations for capturing high-quality selfies.

Q4. Story for General Audience

In a world where selfies have become an essential part of daily communication and social media engagement, taking the *perfect selfie* can make a significant difference. Our study aimed to uncover the secrets behind high-quality selfies by focusing on two simple but powerful factors: **facial expression** and **background type**. We asked 10 participants to take selfies in four different scenarios: with a **neutral expression or a big smile**, and against a **simple background or a decorative background**. Each photo was rated by a panel of three judges for clarity, appeal, and overall aesthetics. The results were clear—smiling broadly and choosing a decorative background led to the highest-rated selfies. A big smile conveyed warmth and approachability, while a vibrant background added visual interest and context, making the photo more engaging.

So, what does this mean for anyone looking to improve their selfies? The findings are simple but effective: if you want your selfies to stand out, **smile big and look for an interesting background!** Whether you're posting on social media, updating your profile picture, or capturing memories with friends, a cheerful expression and an eye-catching setting can boost the appeal of your photo. Our research shows that while both factors independently improve selfie quality, their combined power helps create truly captivating images. Next time you snap a selfie, remember to flash a smile and find a background that enhances your story.

Q5. Ways to Improve the Experiment

1. Increase Sample Size:

Including more participants would provide a larger dataset, improving the robustness and reliability of the results.

2. Diverse Participant Demographics:

Recruiting participants from different age groups, ethnicities, and genders could offer more generalizable insights into selfie quality preferences.

3. Additional Independent Variables:

Consider factors like **lighting conditions, camera angles, and filters** to understand their combined effect on selfie quality.

4. Objective Quality Measures:

Use automated image quality analysis tools alongside human judges to provide an unbiased, objective assessment of photo clarity and aesthetics.

5. Larger Judge Panel:

Expanding the panel of judges to include professionals from fields like photography, social media marketing, and design could offer more nuanced evaluations.

6. Environmental Control:

Conduct the experiment in a controlled studio setting to minimize variations caused by external factors such as lighting and weather.

7. Longitudinal Study:

Track participants' selfie-taking habits and social media engagement over time to see if the findings hold true in real-world scenarios.

8. Feedback Collection:

Collect qualitative feedback from participants and judges to understand subjective perceptions and preferences in greater detail.

9. Different Rating Scales:

Use a more detailed rating scale (e.g., 1 to 20) to capture subtle differences in selfie quality.

10. Interaction with Other Elements:

Explore how clothing, accessories, or facial features interact with facial expression and background type to influence selfie quality.

These improvements could help refine the experiment and provide deeper insights into what makes the perfect selfie.

Use of AI

1. Summary of Existing Knowledge

AI Prompt:

"Provide a summary of best practices for taking high-quality selfies, including factors like facial expression, background, lighting, and composition. Include citations and links to credible sources like photography blogs, academic studies, and professional guides."

2. Experimental Design

AI Prompt for Comments:

"Review the following experimental design for a 2^2 full factorial study on selfie quality. The independent variables are facial expression (neutral vs. big smile) and background type (simple vs. decorative). The dependent variable is selfie quality score, rated by judges. Provide feedback on the clarity and robustness of the design, including suggestions for improvements."

5. Reflection on How to Improve the Experiment

AI Prompt:

"Suggest ways to improve a 2^2 full factorial experiment that evaluates selfie quality based on facial expression and background type. Include ideas for increasing sample size, enhancing demographic diversity, adding control variables, and incorporating different evaluation methods."