

2025

BUSINESS STATISTICS: METHOD AND APPLICATION

A/B TESTING

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Task Overview

01

TASK 1

Whether the Dark and Ominous or the Happy and Bright music should accompany the road safety video

02

TASK 2

Whether there is any evidence that the kind of music played during the road safety video affects respondents' perceptions of the effectiveness of the railway safety video;

03

TASK 3

Whether running the A/B test for two years was excessive and whether running it for a shorter length of time might have been better.



Method

O1

Frequentist Approach

- Descriptive analysis
- Null hypothesis : Music does not affect the respondent's perception regarding whether the child is hit by the car.
- Hypothesis Test
- Conclusion regarding the influence of music on respondents' perception.

O2

Bayesian Approach

- Descriptive analysis
- Define the prior distribution
- Calculate the posterior distribution
- Compute the probability that one music wins over the others
- Define an optimal number of pairwise allocations to achieve a satisfactory result

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Hypothesis testing

Road safety video	
Null hypothesis	$H_0 : p_0 - p_1 = 0$
Test statistic	1.823
Critical value	1.96

Railway safety video	
Null hypothesis	$H_0 : p_0 - p_1 = 0$
Test statistic	0.979
Critical value	1.96

- Test statistic < Critical value
- Insufficient evidence to reject the null hypothesis
- No significant difference between Dark and Happy music



Method

O1

Frequentist Approach

- Descriptive analysis
- Null hypothesis : Music does not affect the respondent's perception regarding whether the child is hit by the car.
- Hypothesis Test
- Conclusion regarding the influence of music on respondents' percepto.

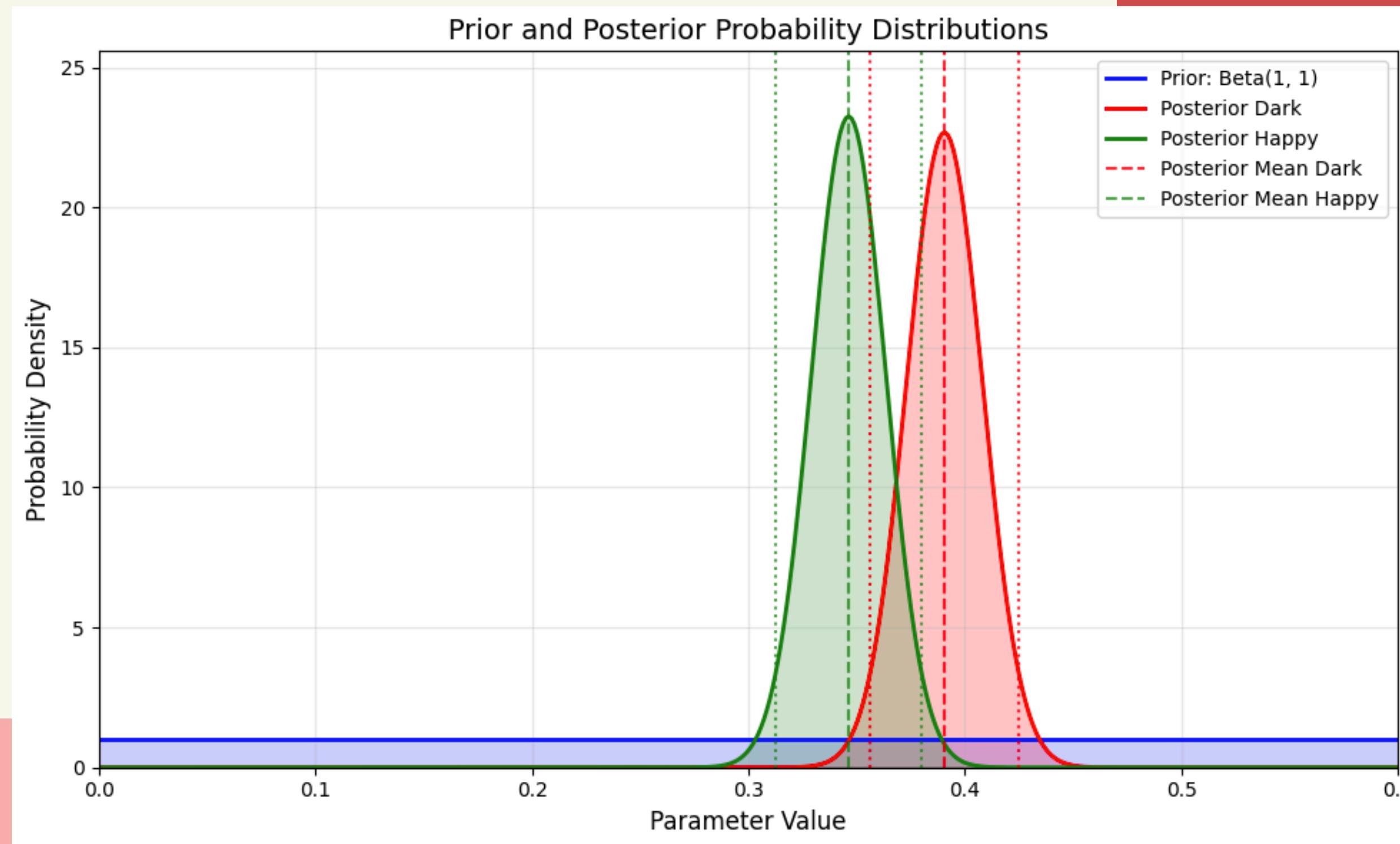
O2

Bayesian Approach

- Descriptive analysis
- Define the prior distribution
- Calculate the posterior distribution
- Compute the probability that one music wins over the others
- Define an optimal number of pairwise allocations to achieve a satisfactory result

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Plot posterior distribution

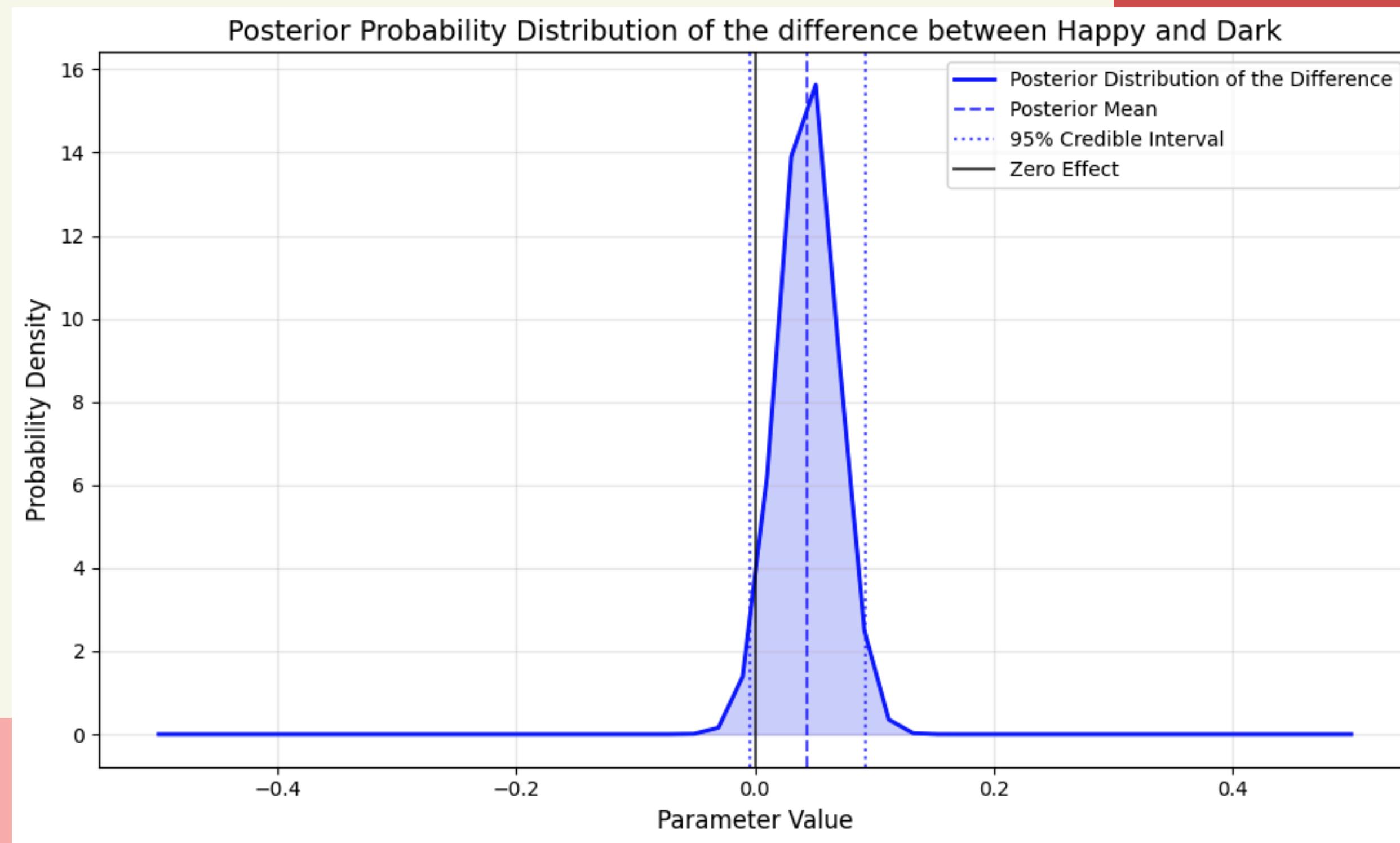


Credible Interval for Dark:
(0.3561, 0.4251)

Credible Interval for Happy:
(0.3127, 0.3800)

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Plot difference posterior distribution

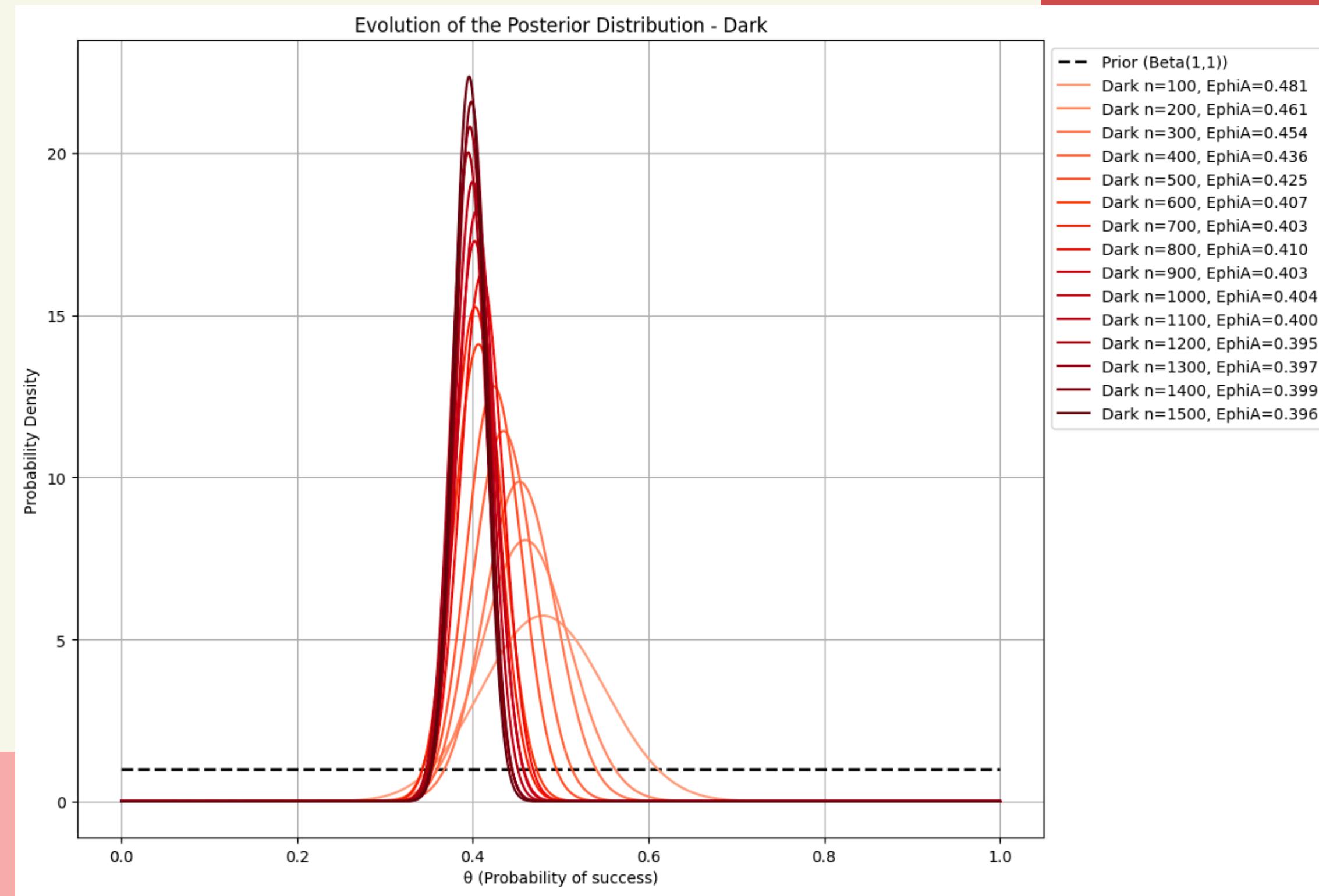


95% Credible Interval:
(-0.0039, 0.0924)

Probability of $\pi > 0$:
(0.9642)

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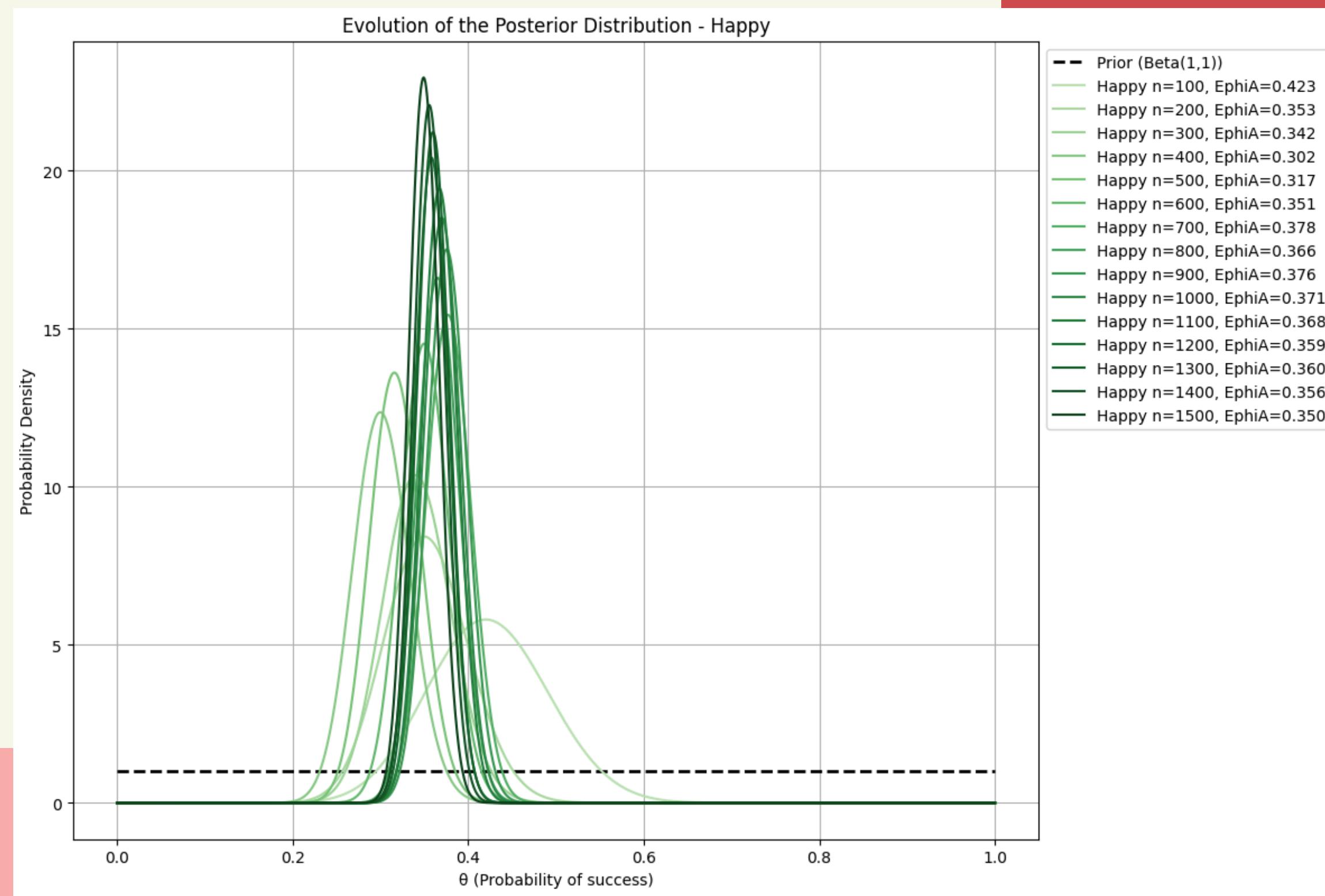
Evolution Dark posterior distribution



- Plot shows the evolution of the 'Dark' posterior distribution
- Beta distribution updated every 100 observations

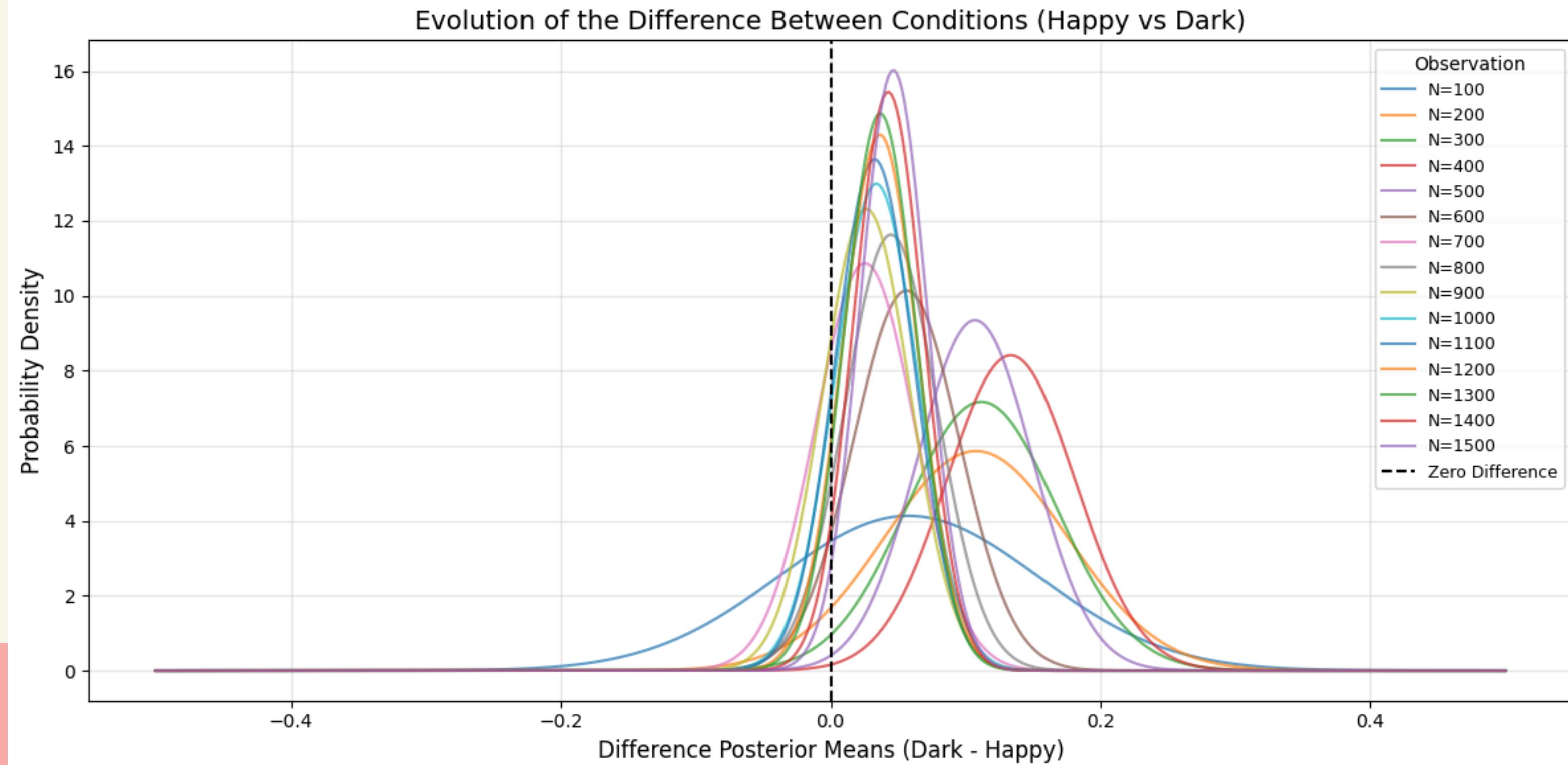
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Evolution Happy posterior distribution

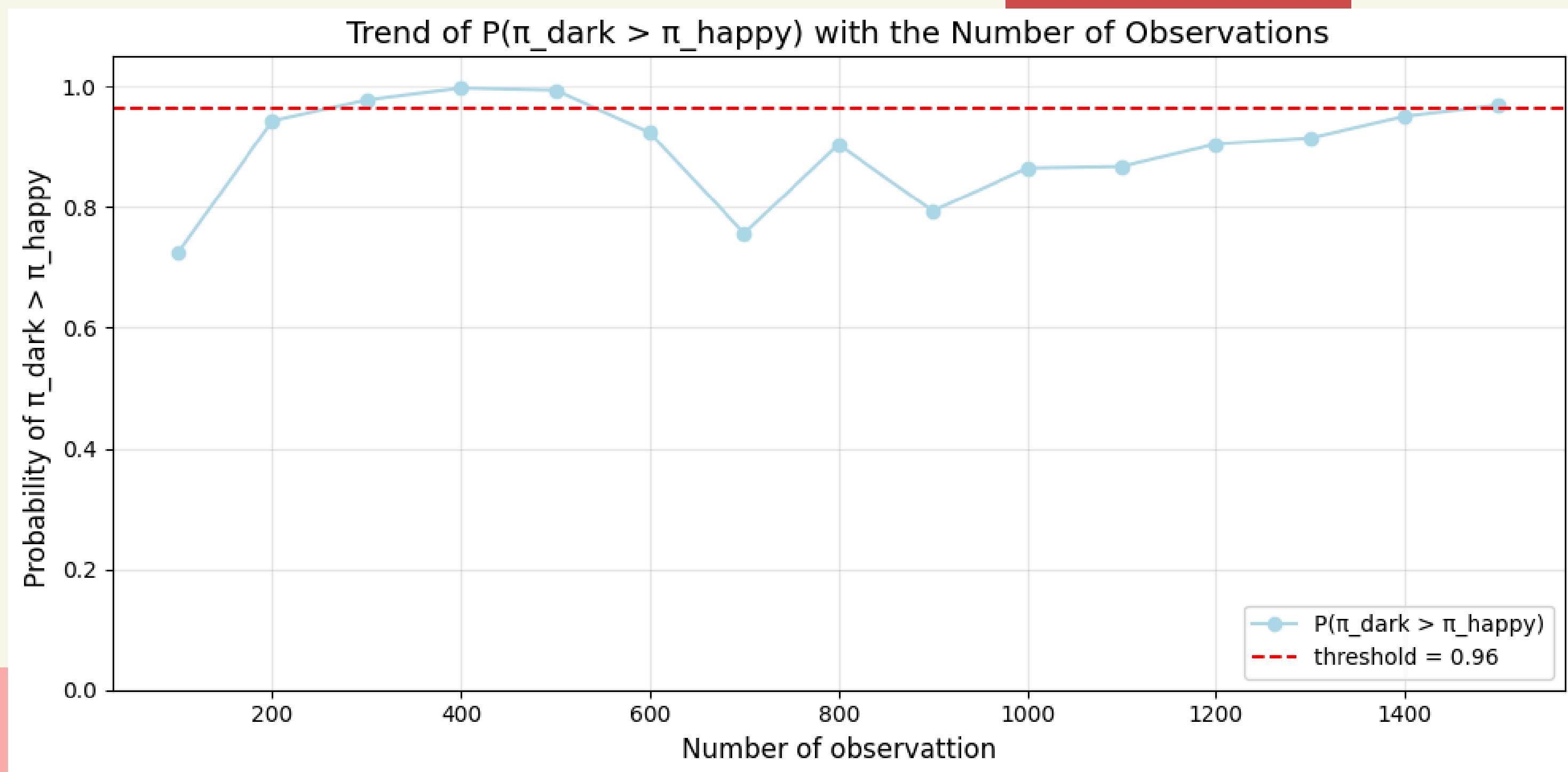


- Plot shows the evolution of the 'Happy' posterior distribution
- Beta distribution updated every 100 observations

Evolution difference posterior distribution



Trend of P (π dark > π happy)





OUR STOPPING CRITERIA IN A/B TESTING

Number of observations	$P(\pi_{\text{dark}} > \pi_{\text{happy}})$
100	0.7250
200	0.9435
300	0.9779
400	0.9976
500	0.9940
600	0.9237
700	0.7569

800	0.9042
900	0.7938
1000	0.8650
1100	0.8677
1200	0.9049
1300	0.9150
1400	0.9510
1500	0.9692

RULES

- After 50 pairwise allocations, if the probability of Dark winning is greater than 80%, stop.
- If not, perform 50 additional pairwise allocations.
- Increase the target probability by 2.5% after each set of 50 allocations.
- Repeat until the probability of Dark winning meets the chosen criterion.



Conclusion

01

Frequentist Approach

The method suggests no significant difference between Happy and Dark music in both videos (Safety Road and Railway), by not rejecting the Null Hypothesis

02

Bayesian Approach

The analysis reveals a significant difference between Happy and Dark music across both videos (Safety Road and Railway), with a confidence level of 96%. Specifically, Dark music appears to exert a stronger influence on respondents' perception of the likelihood of an accident, suggesting it as a more impactful choice for advertising purposes.

Thank You

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