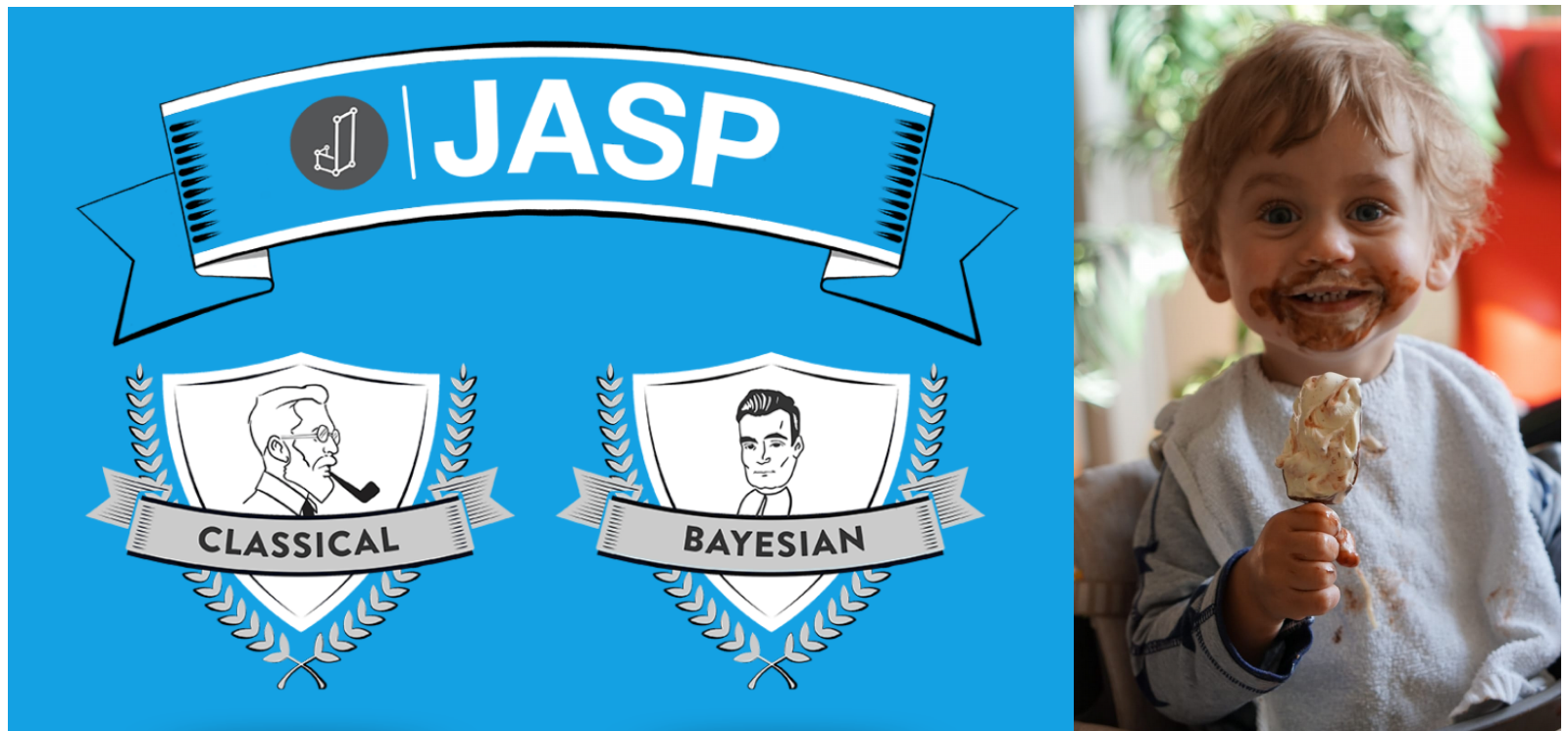


Bayesian Inference Without Tears



E.-J. Wagenmakers

What is Bayesian Inference?

What is Bayesian Inference?



“Common sense expressed in numbers”

What is Bayesian Inference?



“Common sense expressed in numbers”

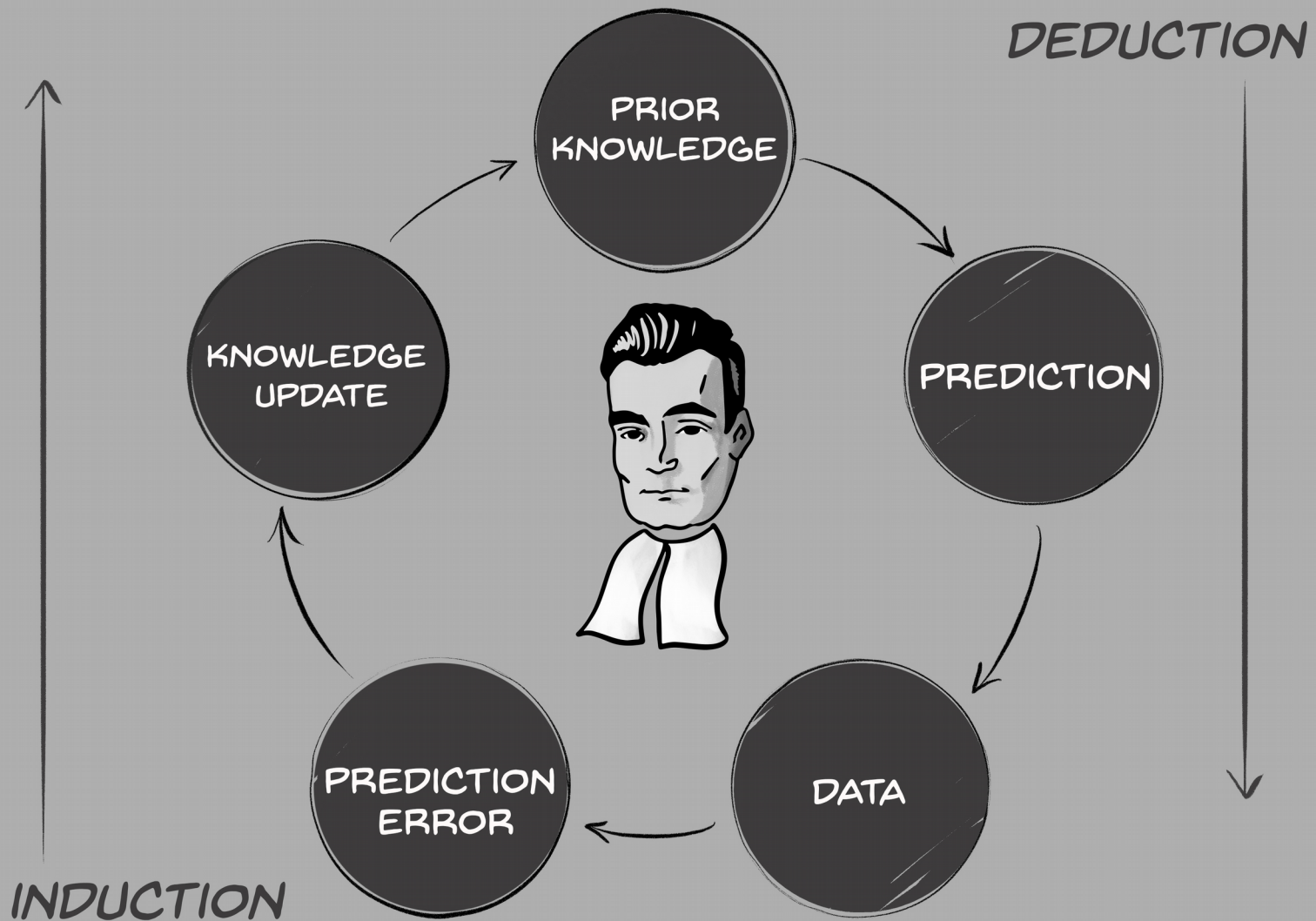


“The only good statistics”

What is Bayesian Inference?

“The outcome of a learning process that is governed by relative predictive success”

BAYESIAN LEARNING CYCLE





THE PRINCIPLES OF SCIENCE

A TREATISE ON LOGIC
AND
SCIENTIFIC METHOD

BY
W. STANLEY JEVONS
LL.D. (EDINB.), M.A. (LOND.), F.R.S.



Bayes' Rule

$$\underbrace{p(\theta \mid \text{data})}_{\text{Posterior beliefs about parameters}} = \underbrace{p(\theta)}_{\text{Prior beliefs about parameters}} \times \underbrace{\frac{p(\text{data} \mid \theta)}{p(\text{data})}}_{\text{Predictive updating factor}}$$



Bayes' Rule

$$\underbrace{\frac{p(\theta \mid \text{data})}{p(\theta)}}_{\text{Support}} = \underbrace{\frac{p(\text{data} \mid \theta)}{p(\text{data})}}_{\text{Predictive success}}$$



THE TWO FACES OF BAYES' RULE



$$\begin{array}{ccc} \text{CHANGE IN BELIEF ABOUT } \theta & \left\{ \frac{\overbrace{p(\theta | \text{data})}^{\text{POSTERIOR BELIEF ABOUT } \theta}}{\underbrace{p(\theta)}_{\text{PRIOR BELIEF ABOUT } \theta}} \right\} & = & \left\{ \frac{\overbrace{p(\text{data} | \theta)}^{\text{PREDICTIVE ADEQUACY OF } \theta}}{\underbrace{p(\text{data})}_{\text{AVERAGE PREDICTIVE ADEQUACY}}} \right\} \text{RELATIVE PREDICTIVE ADEQUACY OF } \theta \end{array}$$

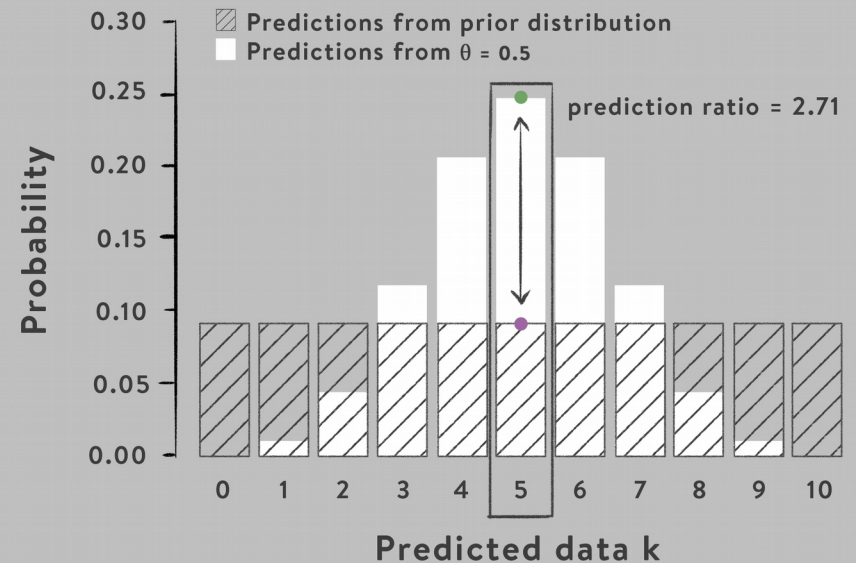
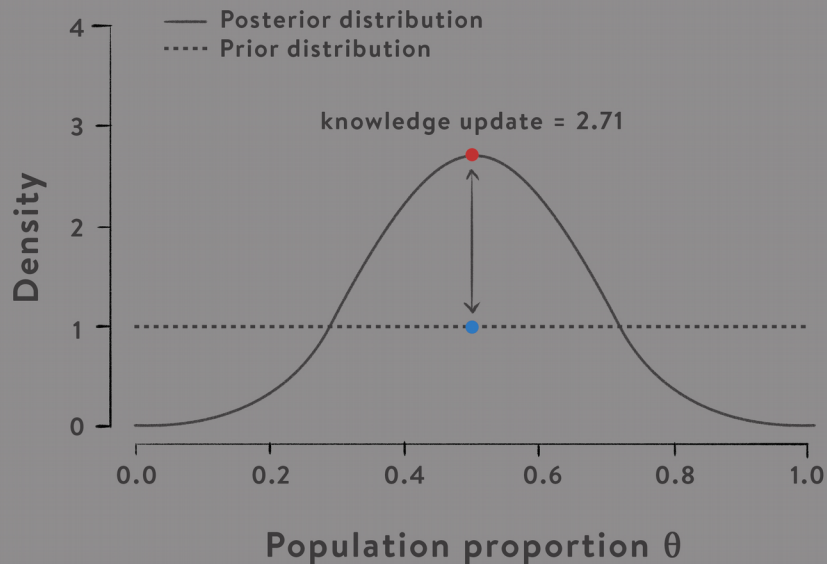


THE TWO FACES OF BAYES' RULE

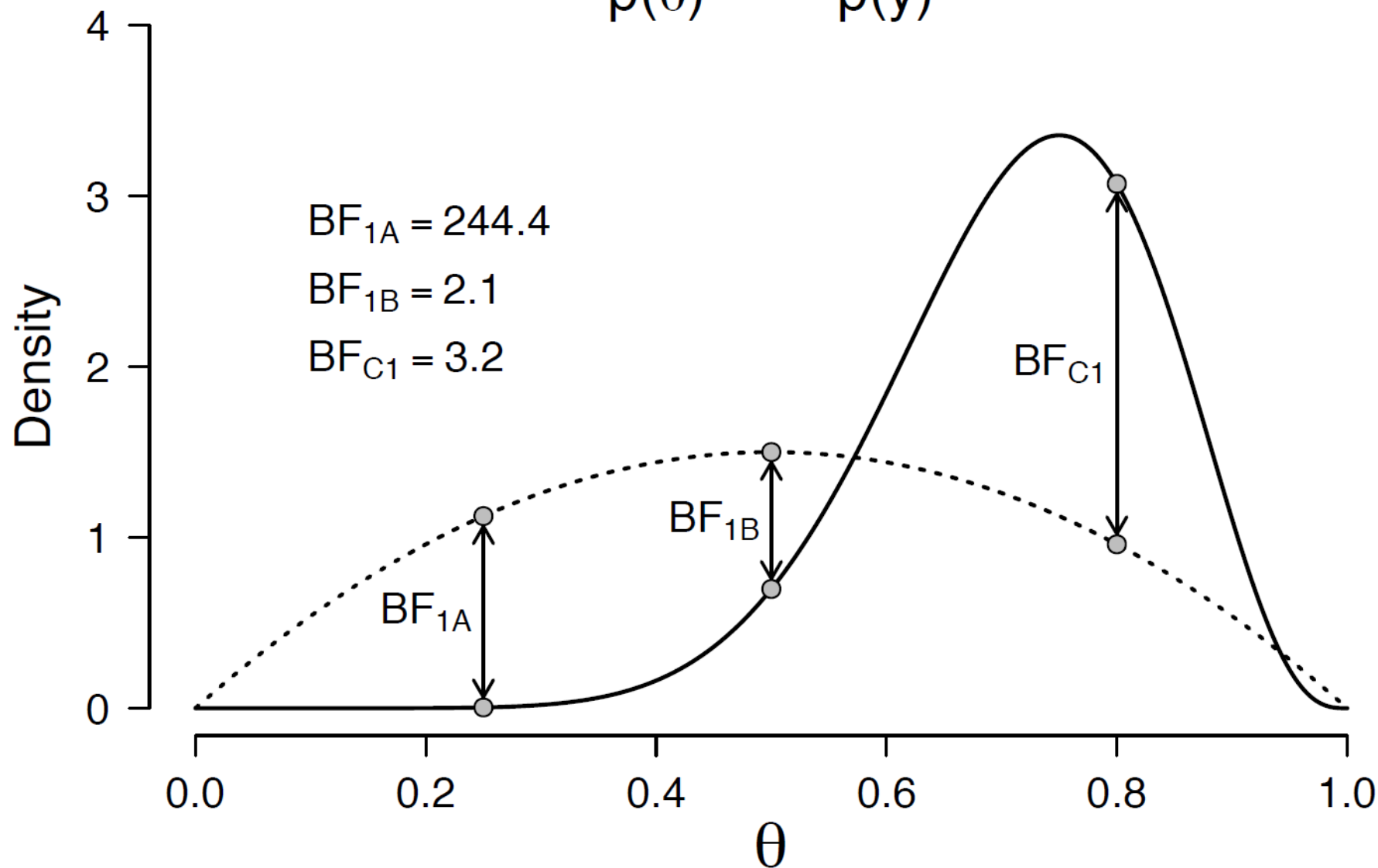


$$\begin{array}{ccc} \text{CHANGE IN BELIEF ABOUT } \theta & \left\{ \frac{p(\theta | \text{data})}{p(\theta)} \right\} & = & \left\{ \frac{p(\text{data} | \theta)}{p(\text{data})} \right\} & \text{RELATIVE PREDICTIVE ADEQUACY OF } \theta \\ \text{POSTERIOR BELIEF ABOUT } \theta & & & & \text{PREDICTIVE ADEQUACY OF } \theta \\ \text{PRIOR BELIEF ABOUT } \theta & & & & \text{AVERAGE PREDICTIVE ADEQUACY} \end{array}$$

What about $\theta = 0.5$ for $k = 5$ successes out of $n = 10$ attempts?



$$\frac{p(\theta \mid y)}{p(\theta)} = \frac{p(y \mid \theta)}{p(y)}$$





BAYESIAN SPECTACLES

Powered by JASP

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Bayes Factors for Those Who Hate Bayes Factors

POSTED ON NOV 3RD, 2017



This post is inspired by Morey et al. (2016), Rouder and Morey (in press), and Wagenmakers et al. (2016a).

The Misconception

Bayes factors may be relevant for model selection, but are irrelevant for parameter estimation.

The Correction

powered by

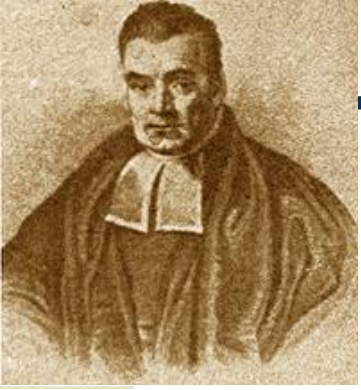


JASP

A Fresh Way to Do Statistics

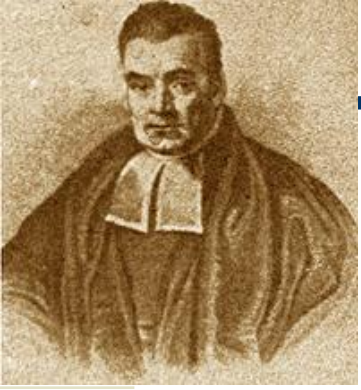


Bayesian Spectacles is powered by JASP: a free, friendly, and flexible software package for conducting statistical analyses. Discover JASP at jasp-stats.org



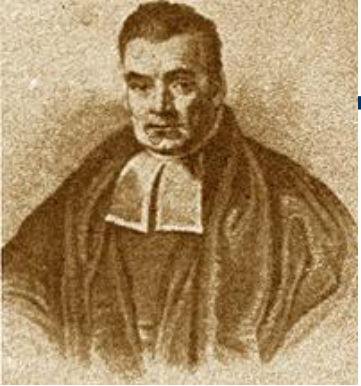
Pragmatic Bayesian Advantages

- ◆ Attach probabilities to parameters and hypotheses;
- ◆ Quantify evidence, for any hypothesis you care to specify;
- ◆ Learn;
- ◆ Monitor the evidential flow as the data come in.



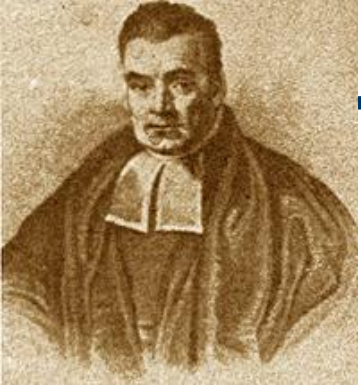
How Do We Best Spread the Faith?

- ◆ Mathematicians: teach practitioners mathematical statistics, so they can derive posterior distributions!



How Do We Best Spread the Faith?

- ◆ Mathematicians: teach practitioners mathematical statistics, so they can derive posterior distributions!
- ◆ Programmers: teach practitioners R, Python, Stan, and/or JAGS, or even how to design their own MCMC routines!



How Do We Best Spread the Faith?

- ◆ Mathematicians: teach practitioners mathematical statistics, so they can derive posterior distributions!
- ◆ Programmers: teach practitioners R, Python, Stan, and/or JAGS, or even how to design their own MCMC routines!
- ◆ Bayesian statisticians: have practitioners collaborate with Bayesian statisticians!



How Do We Best Spread the Faith?

- ◆ Mathematicians and statisticians can derive posterior distributions
- ◆ Programmers like Stan, and/or R, Python, Julia, etc. know how to design efficient samplers
- ◆ Bayesian statisticians and practitioners collaborate





A Fresh Way to Do Statistics

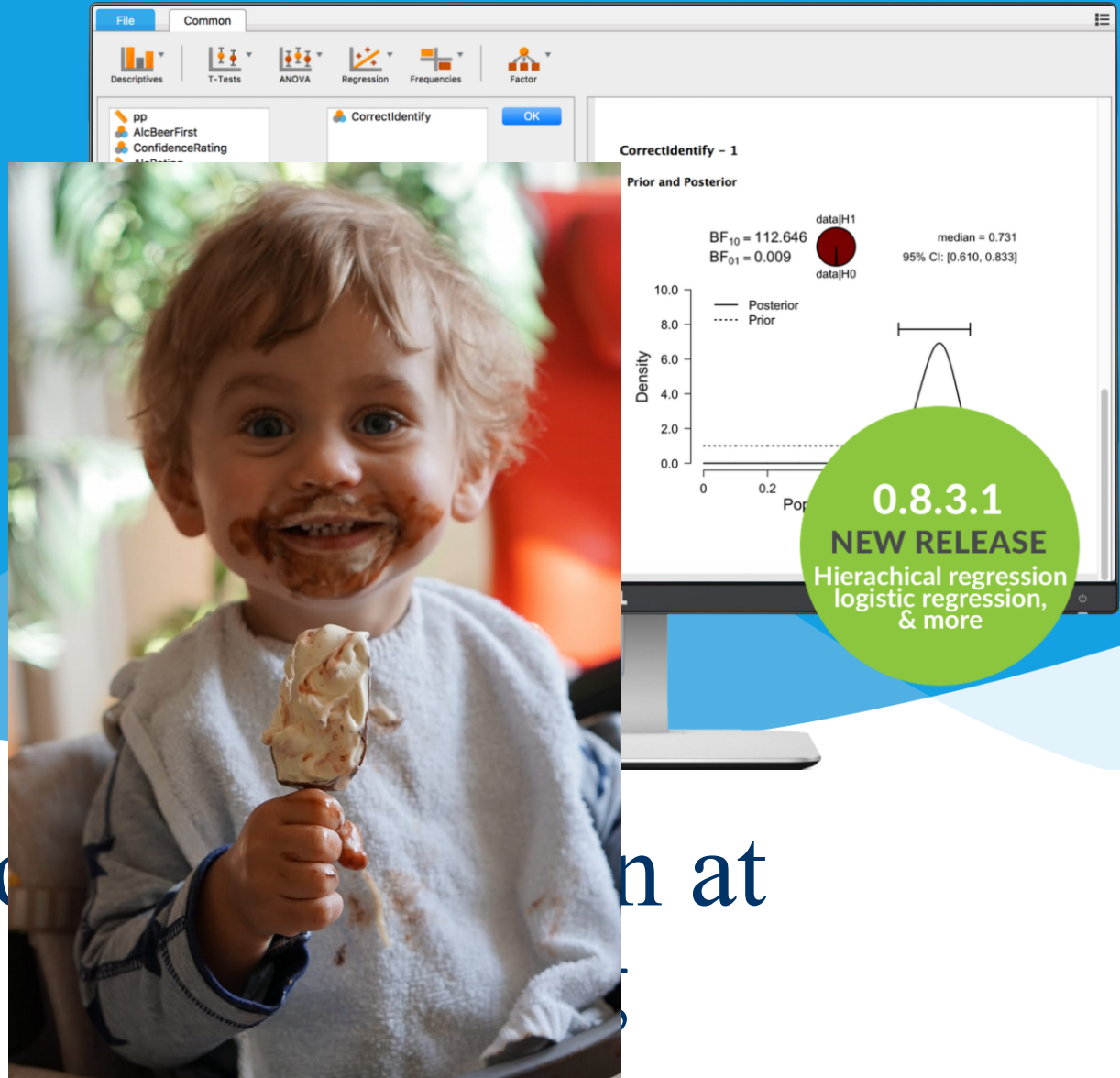
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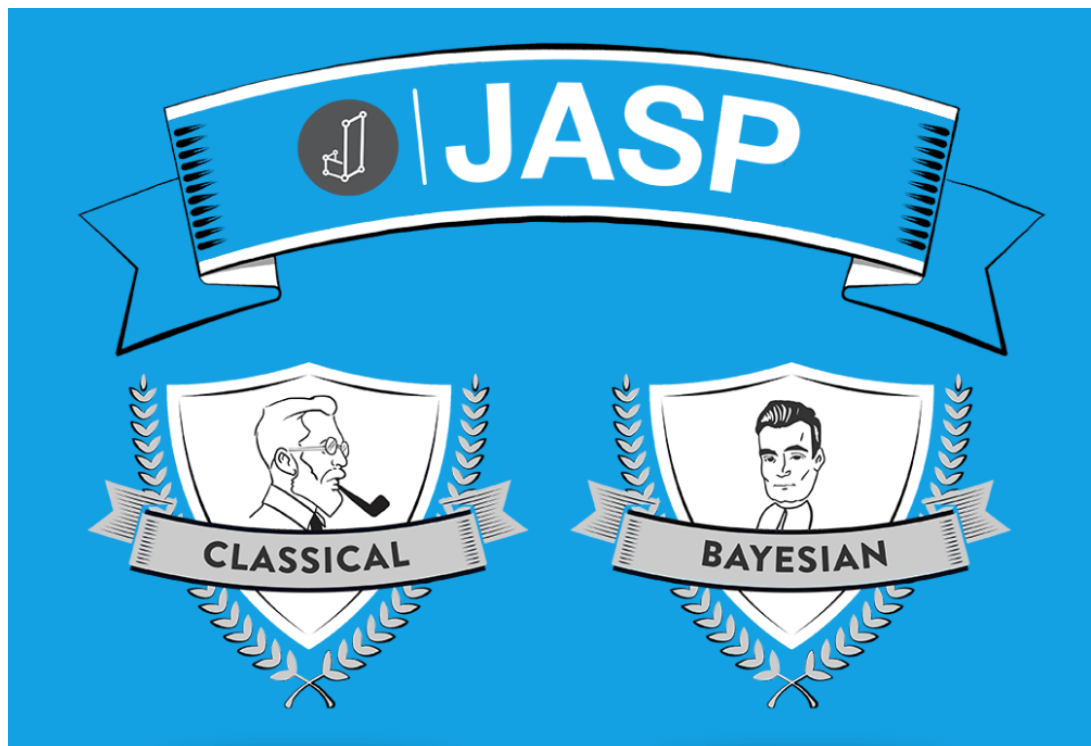
More information at
jasp-stats.org



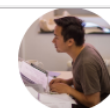
A Fresh Way to Do Statistics

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Model at



Eric-Jan Wagenmakers
CEO / Founder. Guides the development of JASP.
DS GP # in



Alexander Ly
CTO. Responsible for guiding JASP's scientific and technological strategy and developer of some Bayesian tests.
DS GP



Bruno Boutin
Lead Software Developer. Responsible for the core development of JASP.
DS



Frans Meenhoff
Software Developer. Responsible for the core development of JASP.
DS



Akash Raj
Software Developer. Responsible for the implementation of UI elements. Implemented the figures for the Summary Stats module.
DS



Quentin Gronau
Analyst. Contributing to the t-tests and the binomial test. Implemented the figures for the Bayesian analysis.
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Alexandra Sarafoglou
Analyst. Contributing to the multinomial analysis, the video tutorials, and the JASP vignettes.
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Jan G. Voelkel
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Maarten Marsman
Analyst. Responsible for the Bayesian linear models (e.g., ANOVAs and regression).
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Don van den Bergh
Analyst. Responsible for the frequentist and Bayesian reliability analysis, the machine learning module, and the network module. Also part of the vignettes organization team.
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Johnny van Doorn
Analyst. Responsible for Bayesian nonparametric analysis and part of the vignettes organization team.
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Alexander Etz
The voice of many JASP video tutorials and other videos on our YouTube channel.
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Erik-Jan van Kesteren
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Raoul Grasman
Data scientist and code contributor. Responsible for improving code and developing new modules.
DS In



Herbert Hoijtink
Contributing to the Informative Hypotheses module.
DS



Joris Mulder
Contributing to the Informative Hypotheses module.
DS



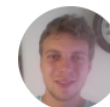
Xin Gu
Contributing to the Informative Hypotheses module.
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Richard Morey
Author and maintainer of the BayesFactor package.
DS



Tim Draws
Marketing and Communication Manager. Responsible for marketing strategy, website, blog, and the YouTube channel.
DS In



Koen Derks
Contributing to the Machine Learning module, and the Bayesian Informative Hypotheses Testing module.
DS In



Joris Goosen
Software developer. Responsible for the core development of JASP.
DS GP



Lotte Kehler
Contributing to the blog, YouTube channel and manual of JASP.
DS In





Encouragement



- ◆ Let me know if you have suggestions for improvement, or if you would like to contribute in some way.
- ◆ Follow JASP on twitter/Facebook and read our weekly blog posts to be up to speed with the latest developments.



A Fresh Way to Learn Bayesian Statistics

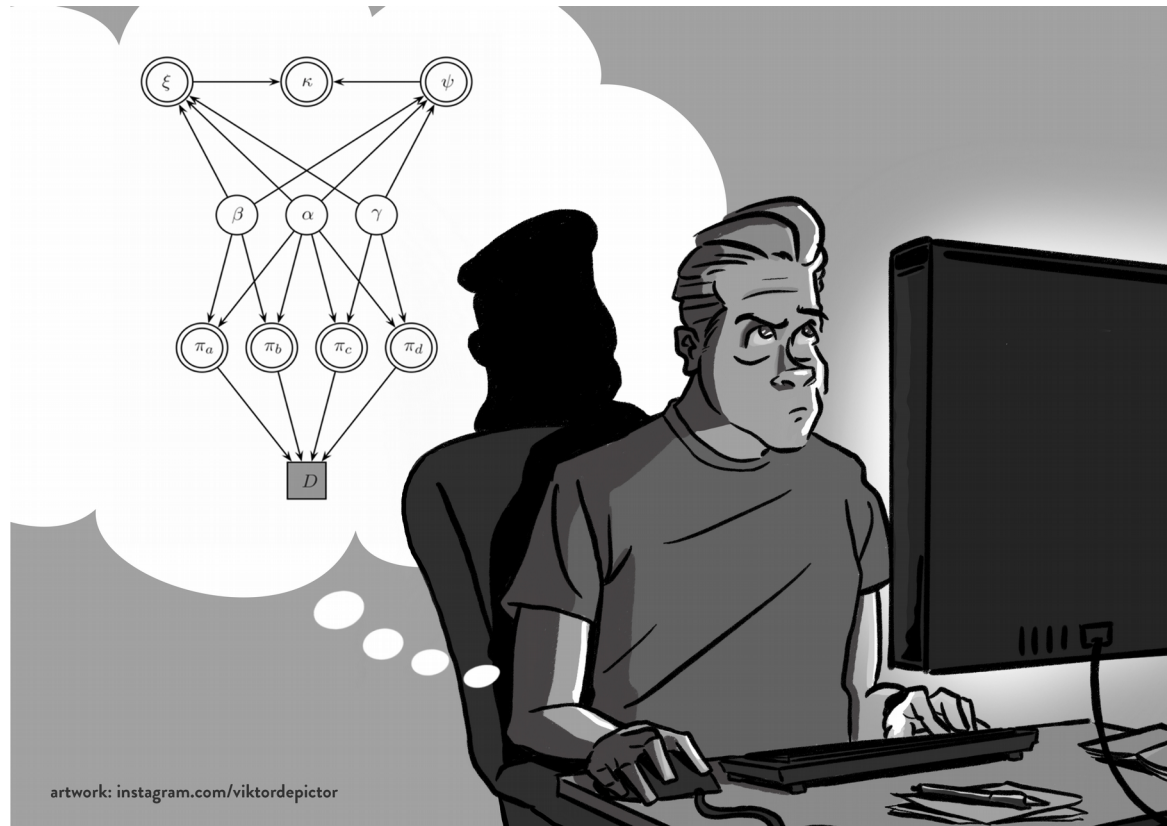


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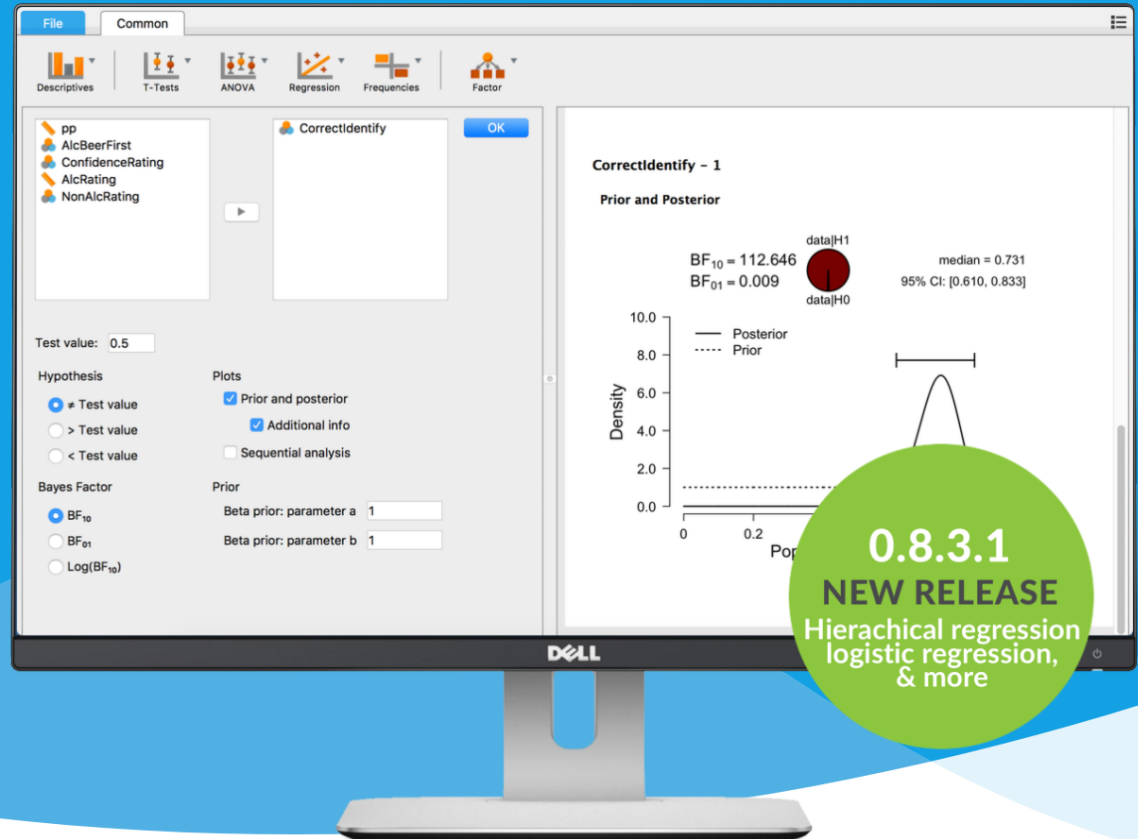
Three JASP Demos

- ◆ Adam Sandler (correlation)
- ◆ Rating Cartoons (t-test)
- ◆ World Happiness (linear regression)



A Fresh Way to Do Statistics

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