

Emotions and Facial Expressions:
Theoretical, Operational, Methodological, and Statistical
Considerations for Modern Open Research

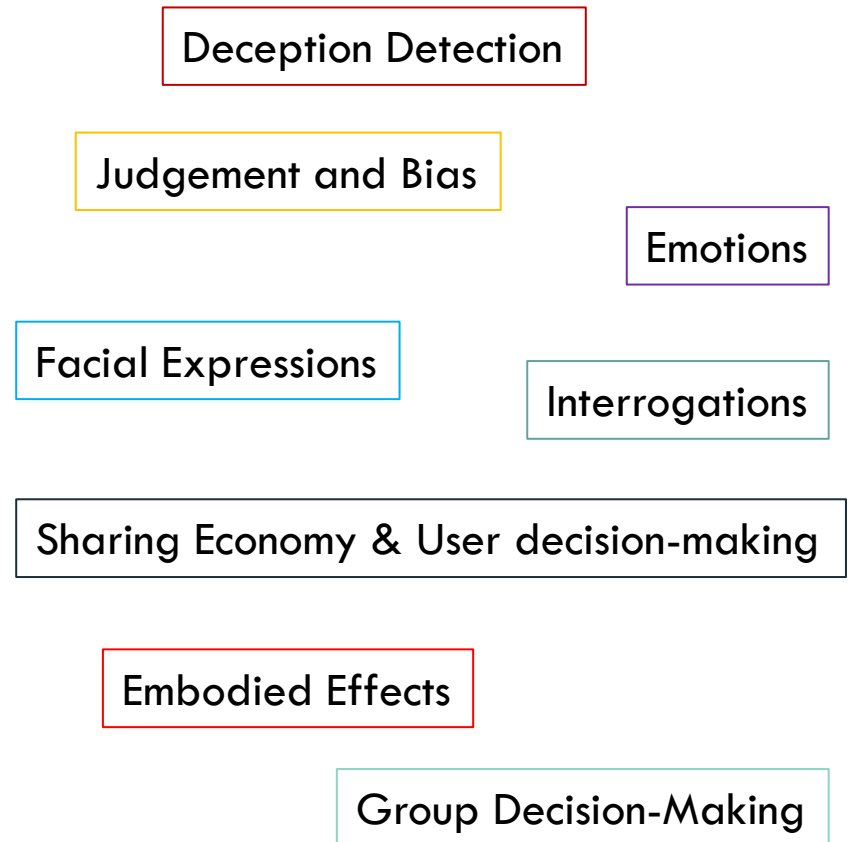
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ME

- Senior Lecturer in Investigative Psychology & Criminology at Kingston University London (Present)
- Experimental Psychologist (PhD)
- Focus on judgement under uncertainty
- Open Science & Reproducibility
- Some Bayesian stuff, some R

Figuring Stuff Out (stats blog)

<https://mzstats.blogspot.com/>



EMOTION THEORY

[Theoretical Aspects]



Variable

UNSEEN FEATURES

Similar

Appraisal: Descriptive

Construction: **Barrett**

Behavioral Ecology

Functional: **Pollak**

Appraisal / Componential
Process: **Marsella**

Basic Emotion:
Panksepp

Basic Emotion:
Ekman

Basic Emotion:
Martinez

Basic Emotion:
Semantic Space

Construction:
Russell

Functional:
Adolphs

Similar

OBSERVED FE

V

EMOTIONS: UNIVERSAL OR SOCIAL

no consensus on what is an “emotion”

Basic Emotion Theory (BET)

- Universal (same everywhere)
- Require no learning (innate)
- Cross-culturally understood
- Different real and fake expressions
- Vestigial behaviours which need to be “decoded”



facial expressions don't represent all underlying emotions

Behavioural Ecology View (BECV)

- Communication signals (easily understood)
- Co-evolved to be understood by peers
- Vary from group to group (culture, society, etc.)
- Doesn't assume “genuine” and “fake” expressions differ



BEHAVIOURAL DIFFERENCES? “RELIABLE” MUSCLES?

Blind athlete



Sighted athlete



Comparison of Blind and Sighted athletes who just lost a match for a medal



Non-Duchenne Smile



Duchenne Smile

HOWEVER

No such reliable muscles (e.g., Krumhuber & Manstead, 2009)
Authenticity discrimination is poor (e.g., Hess & Kleck, 1994)

EMOTIONAL AUTHENTICITY JUDGEMENTS

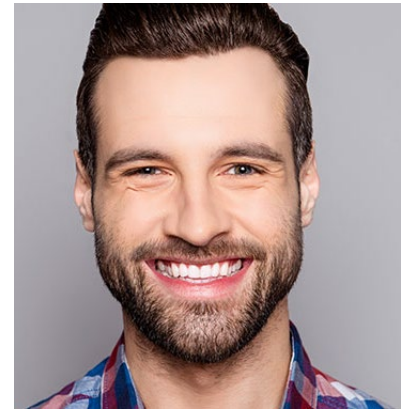
People are good at **classifying** emotional facial expressions (Ekman, 2003)*

Less capable at **discriminating** genuine from non-genuine expressions (Zloteanu, et al., 2018, 2020)

Little evidence for “reliable muscles” (e.g., Krumhuber & Manstead, 2009)

Few studies are designed to make directional claims; having only 2 categories in the stimuli is not informative – nor does it reflect reality

How we operationalize expressions matter! (as we will see shortly)



Label this expression

“Happiness”
CORRECT!

Is the person happy?

“Umm, yes?”
INCORRECT

These are NOT the same task!

FRAMEWORK YOU USE AFFECTS EVERYTHING!

- **Assumptions**

Discrete vs variable | Involuntary vs Communicative | Authenticity exists vs Authenticity is a perceptual feature

- **Predictions**

About effects (size, variance) and judgement processes (detection, training, bias, perception)

- **Methodology**

often non-overlapping e.g., discrete, prototypical, cue-based sets vs production/context-based sets

- **Measurement**

different effects e.g., detection accuracy (%) vs judgement shift

- **Conclusions**

e.g., emotion recognition is linked to “reading” subtle “cues” vs emotions are communicative signals

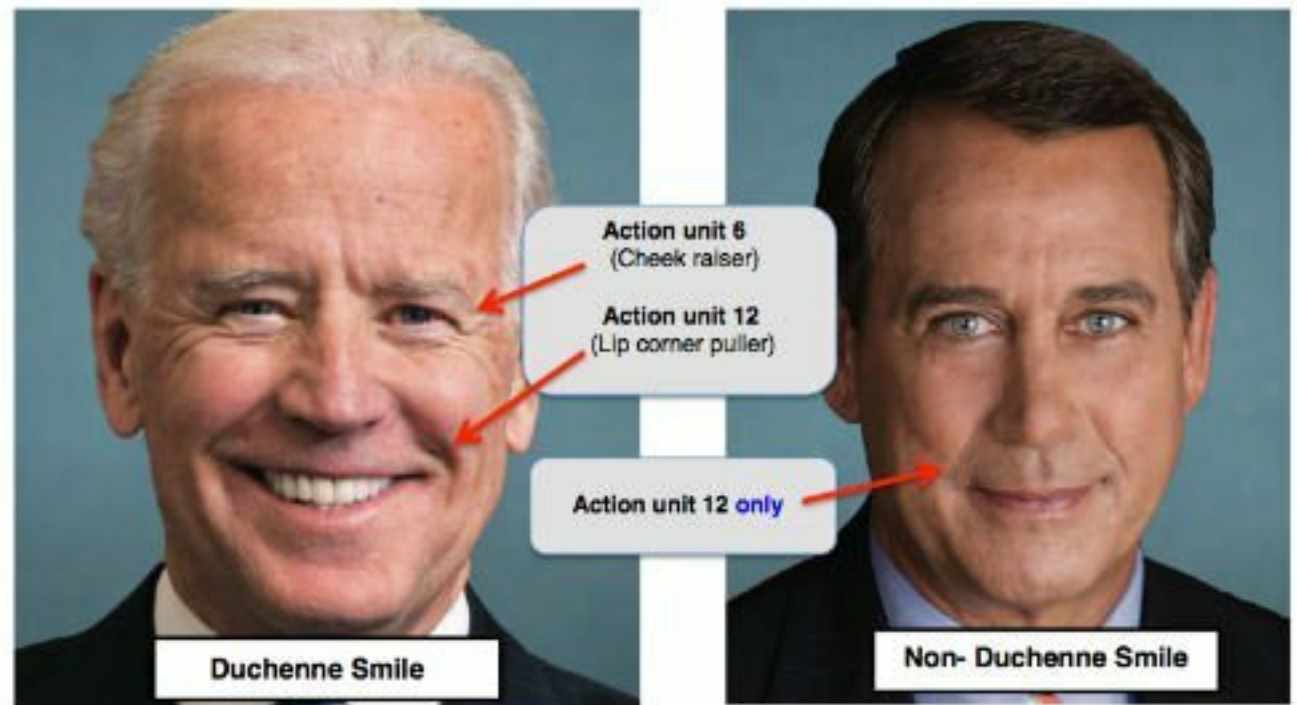


FOR INSTANCE: STIMULI

If you ascribe to BET:

- Instruct “senders” (dif. ways)
- Activation of specific facial muscles
- Use coding (FACS) to check
- If activation = pattern [correct]
- If activation \neq pattern [incorrect]

[Intellective task]



CORRECT ACTIVATION
Use in “Genuine”

INCORRECT ACTIVATION
Use in “Non-Genuine”

FOR INSTANCE: STIMULI

If you ascribe to BECV

- Construct situation to elicit an emotion
- Record the activity
- You “ignore” variance
- No coding per se
- Group based on context, not performance



CONTEXT

[Judgemental Task]

BRIEF ASIDE: DECEPTION DETECTION

[My interests]

DETECTING LIES AND TRUTHS

People lie often and for various reasons

However, detection rates are ~54%

Bias towards believing others are honest



No one definitive cue of lying

Meta-analyses find (inconsistent) clusters of “cues”

EMOTION RECOGNITION AND DECEPTION DETECTION

Traditional Logic (BET):

1. emotional “cues” differ based on genuine and deceptive behaviour
2. emotion recognition relates to accurately “reading” emotional cues (e.g., empathy)
3. empathy may play a role in authenticity judgements

Prediction: Empathic people are better at spotting deceivers’ *leaked* emotions

New Logic (BECV):

1. empathy relates to emotion recognition
2. **but**, only when those emotions are genuine
3. when the cues are insincere, empathy will **hinder** deception detection (misinterpretation)

Prediction: Higher levels of empathy will negatively relate with emotional lie detection

DECEPTION DETECTION RESULTS: INTERPRETATION

Empathic judges perform worse at lie detection.

Explanations:

- Empathic people have difficulty discriminating fabricated emotional cues (**BECV compatible**) (**BET incompatible**)
- Empathy relates to **speed of processing** of emotional information (lower threshold)
 - Emotional information is misinterpreted as signal for truth

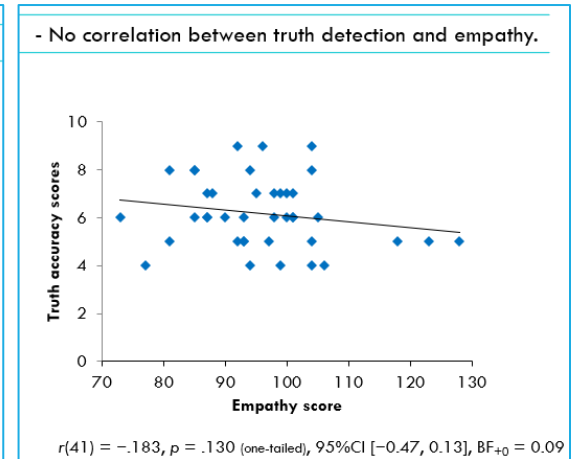
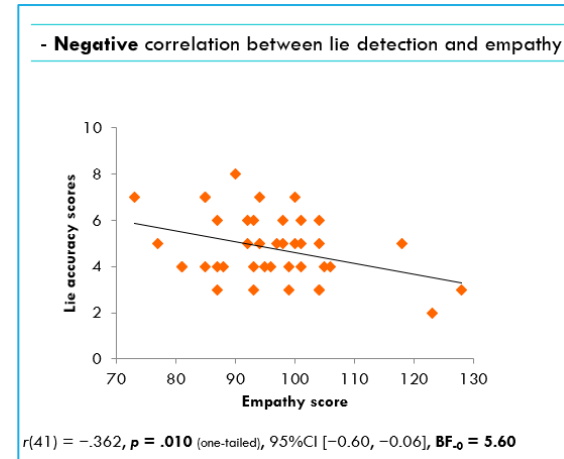


Table 1. Parameter estimates, EE, 95% HDI, Bayes factor, and MPE (N = 106).

Model	Coefficient	95% HDI				BF ₁₀	MPE (%)
		Estimate	EE	Lower	Upper		
Null model	Intercept	-0.09	0.04	-0.17	-0.02	0.07	99.38
	BT	-0.08	0.07	-0.21	0.05	0.01	88.56
	NT	-0.04	0.06	-0.17	0.08	7.29e ⁻³	75.27
	AU	-0.79	0.07	-0.92	-0.66	4.79e⁻¹¹	100.00
	AE	0.37	0.05	0.27	0.47	5.69e⁴	100.00
	Veracity (truth)	0.49	0.05	0.39	0.58	6.90e⁵	100.00
	BT:AU	-0.14	0.12	-0.37	0.09	0.02	87.81
	NT:AU	-0.10	0.11	-0.32	0.12	0.02	81.17
	BT:AE	-0.06	0.09	-0.24	0.13	0.01	73.29
	NT:AE	-0.09	0.09	-0.26	0.09	0.01	83.85
	BT:Veracity	0.06	0.09	-0.11	0.23	9.86e ⁻³	76.27
	NT:Veracity	0.13	0.08	-0.03	0.30	0.03	94.28
	AU:Veracity	0.14	0.09	-0.04	0.32	0.03	93.02
	AE:Veracity	0.03	0.08	-0.12	0.17	7.15e ⁻³	63.19
	BT:AU:Veracity	-0.04	0.17	-0.37	0.29	0.02	59.20
NT:AU:Veracity	0.16	0.16	-0.15	0.48	0.02	83.78	
BT:AE:Veracity	0.03	0.13	-0.24	0.29	0.01	58.00	
NT:AE:Veracity	-0.24	0.13	-0.48	0.01	0.07	96.89	

Check for updates

Original Article

QJEP

Veracity judgement, not accuracy: Reconsidering the role of facial expressions, empathy, and emotion recognition training on deception detection

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SAGE

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Abstract
People hold strong beliefs about the role of emotional cues in detecting deception. While research on the diagnostic value of such cues has been mixed, their influence on human veracity judgements is yet to be fully explored. Here, we address the relationship between emotional information and veracity judgements. In Study 1, the role of emotion recognition in the process of detecting naturalistic lies was investigated. Decoders' veracity judgements were compared based on differences in trait empathy and their ability to recognise microexpressions and subtle expressions. Accuracy was found to be unrelated to facial cue recognition and negatively related to affective. In Study 2, we manipulated decoders' emotion recognition ability and the type of lies they saw: experiential or affective (emotional and unemotional). Decoders received either emotion recognition training, bogus training, or no training. In all scenarios, training did not affect veracity judgements. Experiential lies were easier to detect than affective lies; however, affective unemotional lies were overall the hardest to judge. The findings illustrate the complex relationship between emotion recognition and veracity judgements, with abilities for facial cue detection being high yet unrelated to deception accuracy.

Keywords
Emotion recognition; deception detection; lie; training; facial expression; empathy

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Introduction

Decades of deception research have consistently found that human lie detection ability is poor (Bond & DePaulo, 2006). People are also overconfident in their ability (Holm & Kawagoe, 2010) and biased towards assuming that most statements are honest (i.e., truth-biased; Levine et al., 1999). Some scholars argue that decoders' lacklustre performance is due to their inability to detect subtle behavioural differences between liars and truth-tellers, especially related to emotions (Ekman, 2003a). Implicitly, this assumes that (1) there exist diagnostic behavioural cues of deceit, and (2) decoders can make rational veracity judgements if they use such cues. This approach has resulted in a theoretical standstill (partly due to the low reliability of behavioural cues in predicting deception) and a lack of research on people's veracity judgement processes. Indeed, there are few theoretical models of human veracity judgement, with both classical (e.g., Zuckerman,

DePaulo, & Rosenthal, 1981) and newer attempts (e.g., Levine, 2014b; Street, 2015) placing a growing emphasis on decoders' perception of alleged "cues of deceit," thereby using accuracy as the primary metric of interest. Here, we recontextualise human deception detection, moving away from a focus on accuracy (i.e., the correct perception and interpretation of behavioural cues) towards a

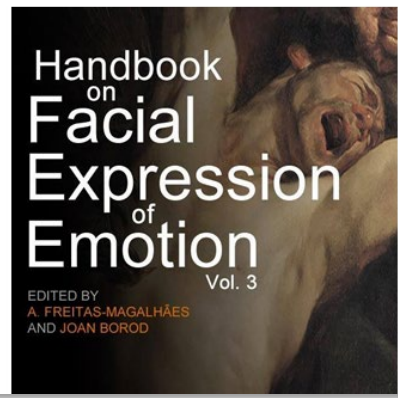
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Reconsidering Facial Expressions and Deception Detection

Mircea Zloteanu

The function of facial expressions of emotions in detecting deception has been a hotly debated topic. One side argues that liars and truth-teller display different facial expressions which can be used as diagnostic cues of deceit. The other argues that such cues are rare, unpredictable, and ambiguous, and as such are unreliable to detecting deception. This chapter overviews facial expression in deception detection, separating their alleged diagnostic value as cues to deception from that of strategic affective signals in human communication. Building upon our current understanding and research in the deception and emotion fields, I elaborate on relevant but underdeveloped concepts, and address how the process of detecting lies can be influenced by facial expressions of emotions. I critically evaluate several assumptions of the emotion-based approach to detecting deception, illustrating the limitations of this view. A strong emphasis is placed on expanding the role of facial expressions in deception, by considering both the encoder-decoder and the affective-signaling perspectives. I propose a careful distinction between genuine cues and deceptive cues, considering the importance of emotional authenticity and sender intent. Finally, I consider the role of facial expressions of emotion in human veracity judgment and future directions for the field of emotion and deception in light of the current propositions. This is done in light of recent propositions to the use of automated lie detection tools on the basis of facial expressions of emotion. I argue that caution must be given to such techniques, elaborating on the flawed underpinnings guiding their decisions, and make considerations for the future of this research.



The role of emotions in detecting deception

Mircea Zloteanu

Abstract

The ability to recognise the emotional states of others is believed to facilitate the detection of deception, but the exact way in which individuals use emotion information has not been fully addressed. Currently, the importance of the stakes to the liar in emotion cue production and the way that this information is utilised by different observer is put into focus. Individual differences in empathic ability are proposed to be a crucial moderator of the relationship between emotion recognition and deception detection. This ability may facilitate deception detection in certain circumstances but may hinder accuracy in others. The aim of this paper is to provide an overview of the way emotions relate to both the process of deception and its detection, and propose avenues of research into this area. A formulation of a model regarding how emotions are expressed and used in various types of lies is proposed, providing testable predictions about the outcome of the deception detection process.

Key Words: Deception Detection, Empathy, Emotion Recognition, Micro-expressions, Subtle expressions, Accuracy.

1. Deception Detection

Deception is defined as the act of deliberately instilling a false belief in another individual.^{1,2} It is prevalent in daily communication, and a necessary component of social interactions.^{3,4,5} As is common, they seem unable to accurately detect lies. Research on deception has found that individuals are often unable to detect lies when others are lying to them, usually finding them more convincing than chance⁶ and are biased towards believing them.⁷ Deception is more than not, regardless of actual veracity.⁷ Deception is influenced by age, gender, experience or even the absence of a single cue. Deception is a poor detection rate is the absence of a single cue, making it very difficult to uncover deception in face-to-face interactions. Research on deception has found that reliable cues are rare and of low validity.^{8,10} A prominent theory of deception on the emotions experienced by the liar, which can theory states that when a liar experiences strong emotions produced as a result of the deception, they will experience strong leakage of these emotions, which can be detected by the observer. Leakage of these cues focuses on the verbal information, which can be detected by the observer. The inhibition of these cues will experience strong

Deception: An Interdisciplinary Exploration

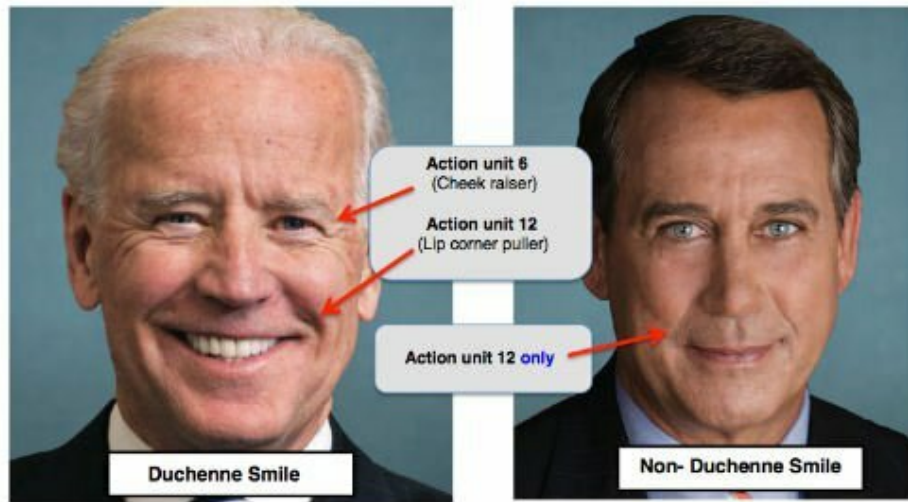


BACK TO EMOTION RESEARCH

AUTHENTICITY DISCRIMINATION

[Operationalisation]

FRAMEWORK DETERMINES STUDY DESIGN



CORRECT ACTIVATION
Use in "Genuine"

INCORRECT ACTIVATION
Use in "Non-Genuine"

CONTEXT

FRAMEWORK DETERMINES STUDY DESIGN



Label this expression

“Happiness”
CORRECT!

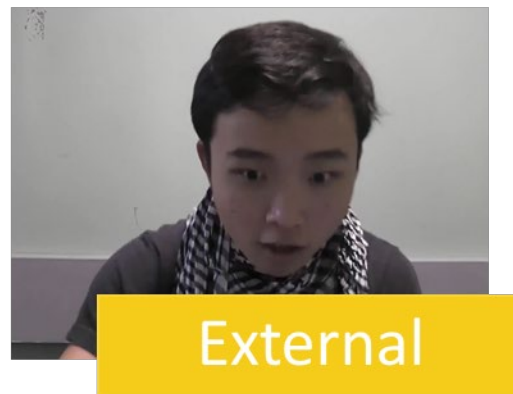
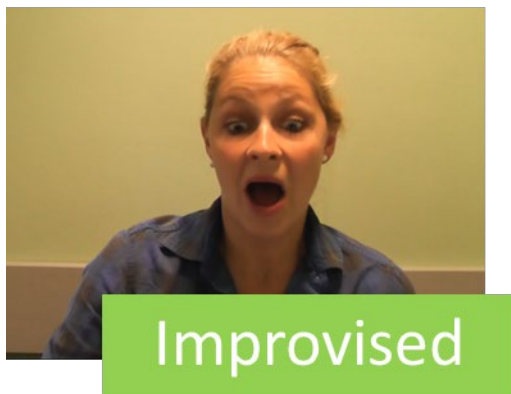
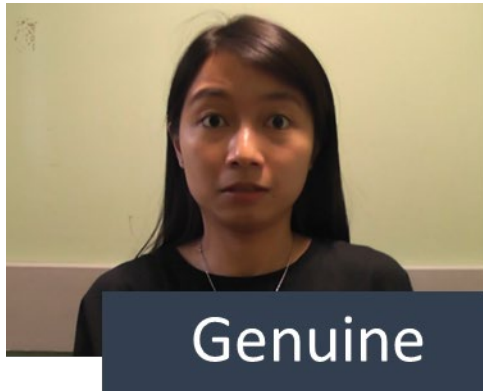


Is the person happy?

“Umm, yes?”
INCORRECT

- Happy
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- Not Happy

EXAMPLE FROM MY RESEARCH



Can people produce genuine-looking facial displays?

Are all deliberate (deceptive) facial displays the same?

Does the production (elicitation) method matter?

We investigated **surprise**.

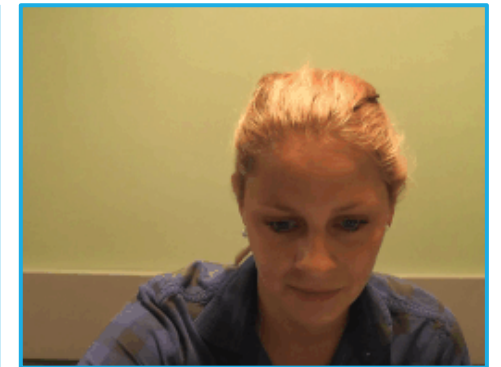
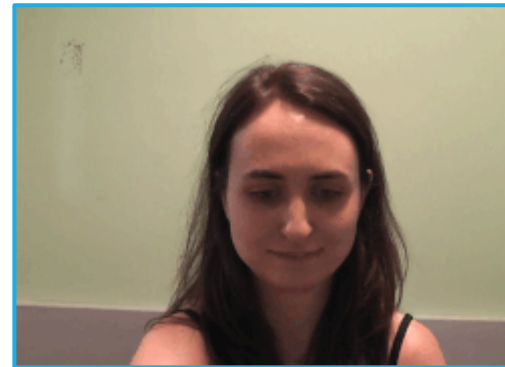
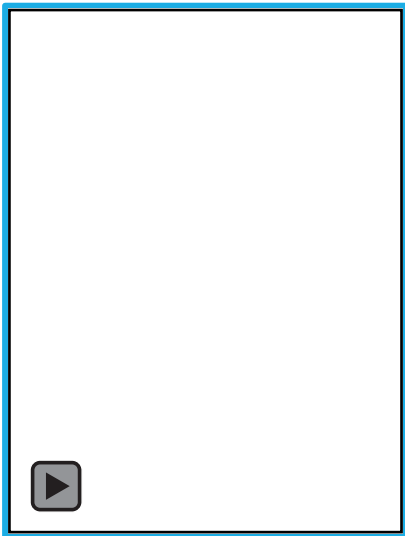
Research Questions:

- Presentation format matters (dynamic v static)
- Production method matters (explains inconsistent results)
- People can produce convincing facial displays

DELIBERATE EXPRESSIONS

Can senders produce genuine-looking expressions which can 'fool' decoders?

Does the production method matter?



STIMULI CREATION (ZLOTEANU, ET AL., 2018; 2020)



PRESENTATION FORMAT

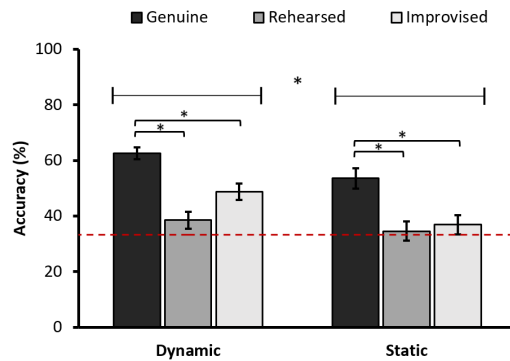
DYNAMIC VS STATIC EXPRESSIONS



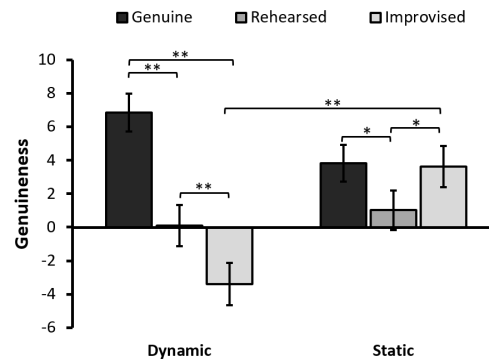
VS



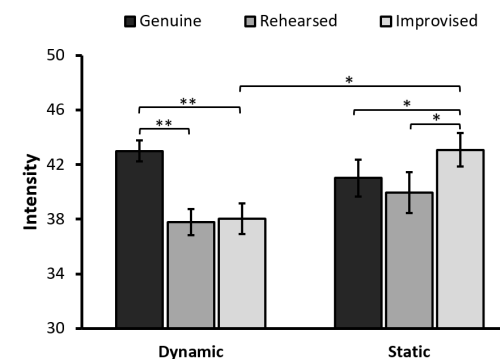
Dynamic > Static ($M_{diff} \approx 10\%$)



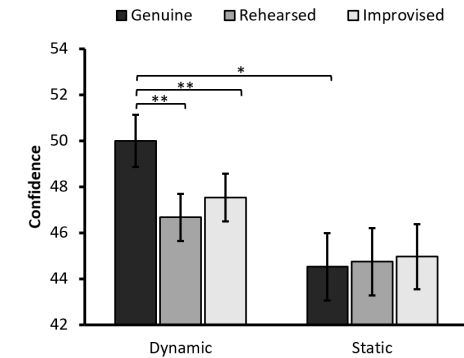
Dynamic v Static
 $Improvised_D < Improved_S$



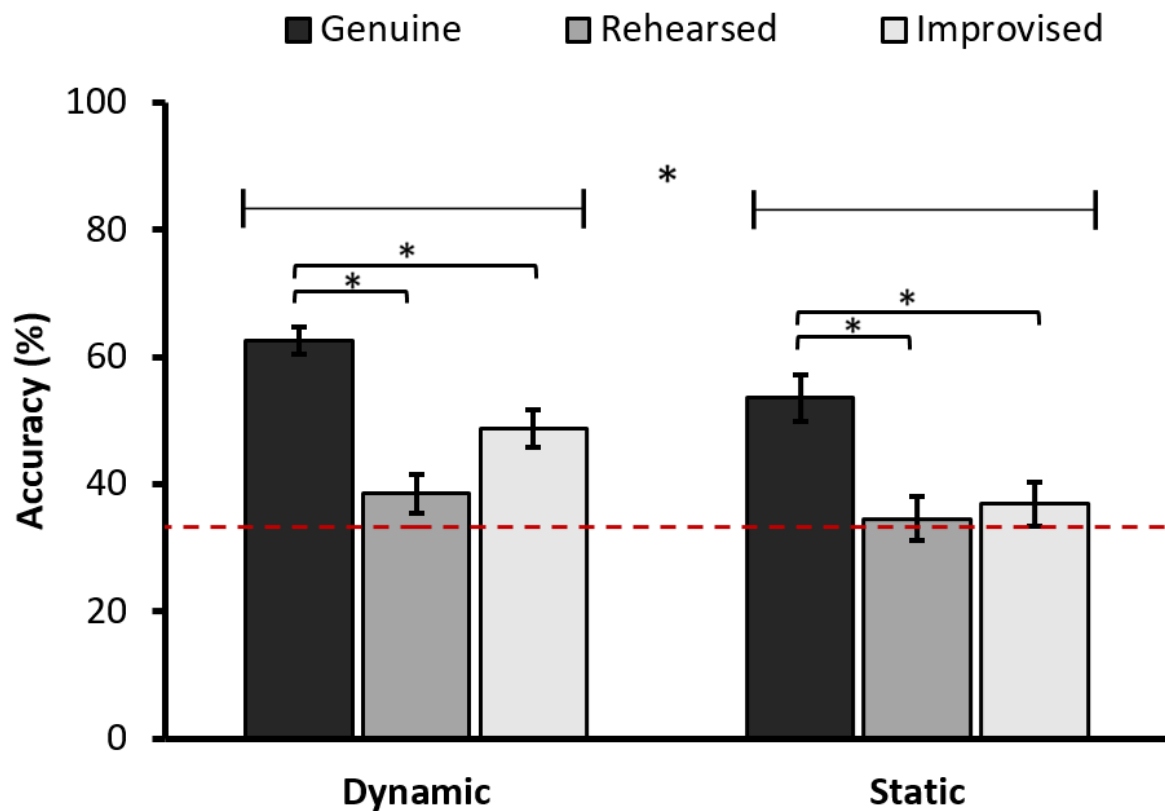
Dynamic v Static
 $Genuine_D = Genuine_S$



Dynamic v Static
 $Genuine_D > Genuine_S$



DISCRIMINATION ACCURACY



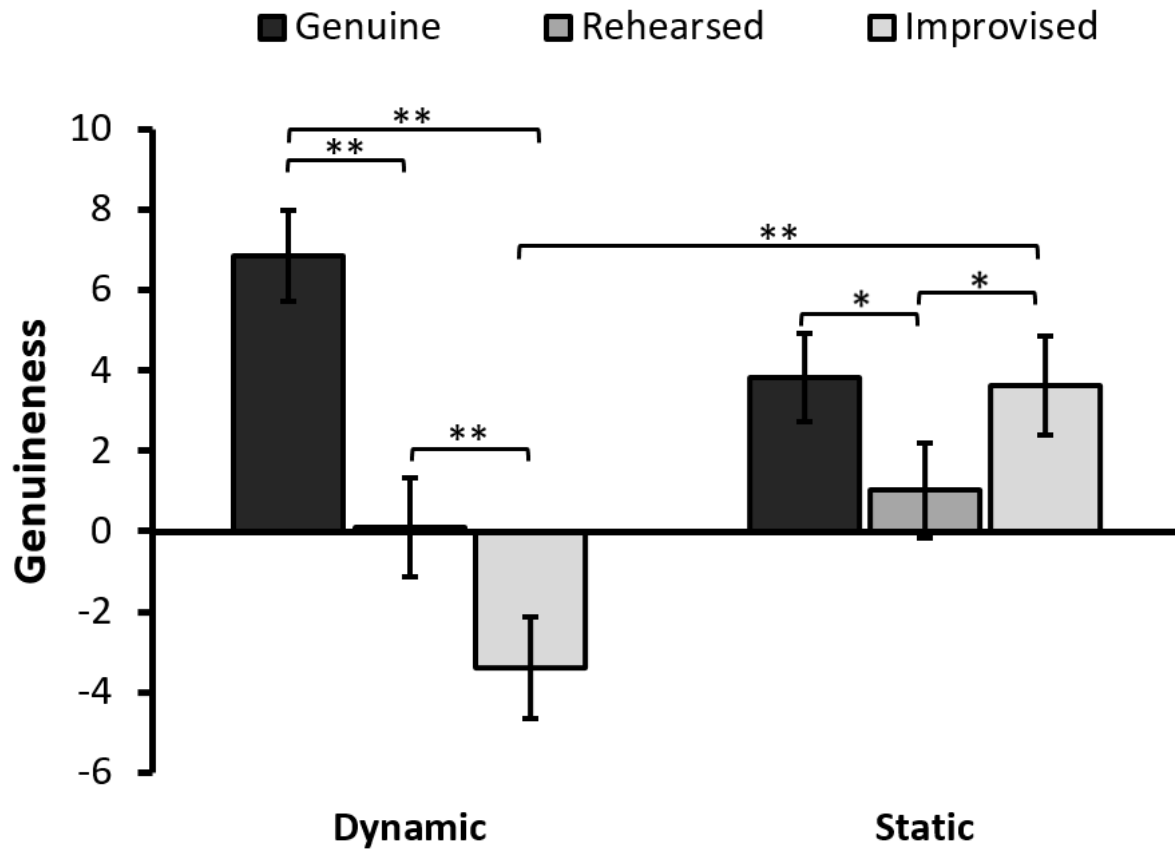
Presentation Format

- Dynamic > Static ($\approx 10\%$)

Expression Condition:

- Genuine > Rehearsed = Improvised

GENUINENESS



Dynamic Condition:

- Genuine > Rehearsed | Improvised
- Improvised < Rehearsed

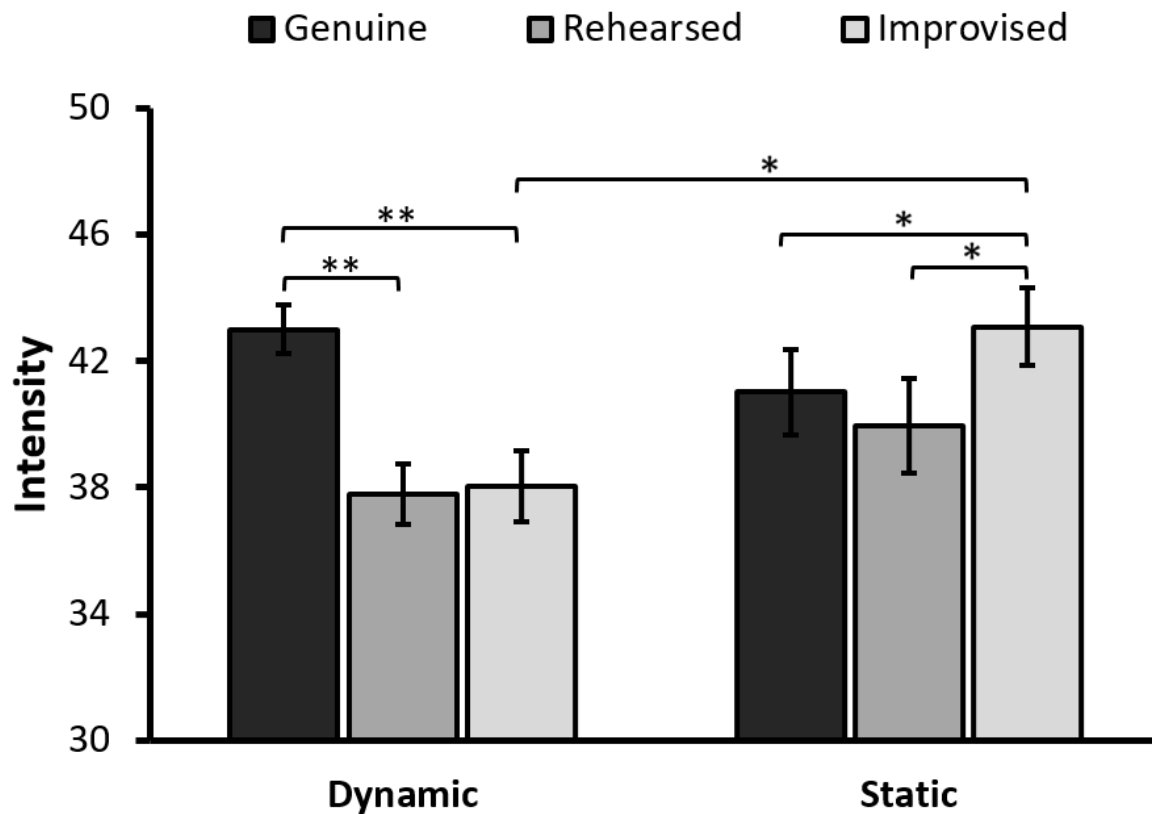
Static Condition:

- Genuine > Rehearsed
- Improvised > Rehearsed
- Genuine = Improvised

Dynamic v Static:

- Improvised Static < Improvised Dynamic
- Genuine Static = Genuine Dynamic
- Rehearsed Static = Rehearsed Dynamic

PERCEIVED INTENSITY



Dynamic condition

- Genuine > Rehearsed | Improvised
- Rehearsed = Improvised

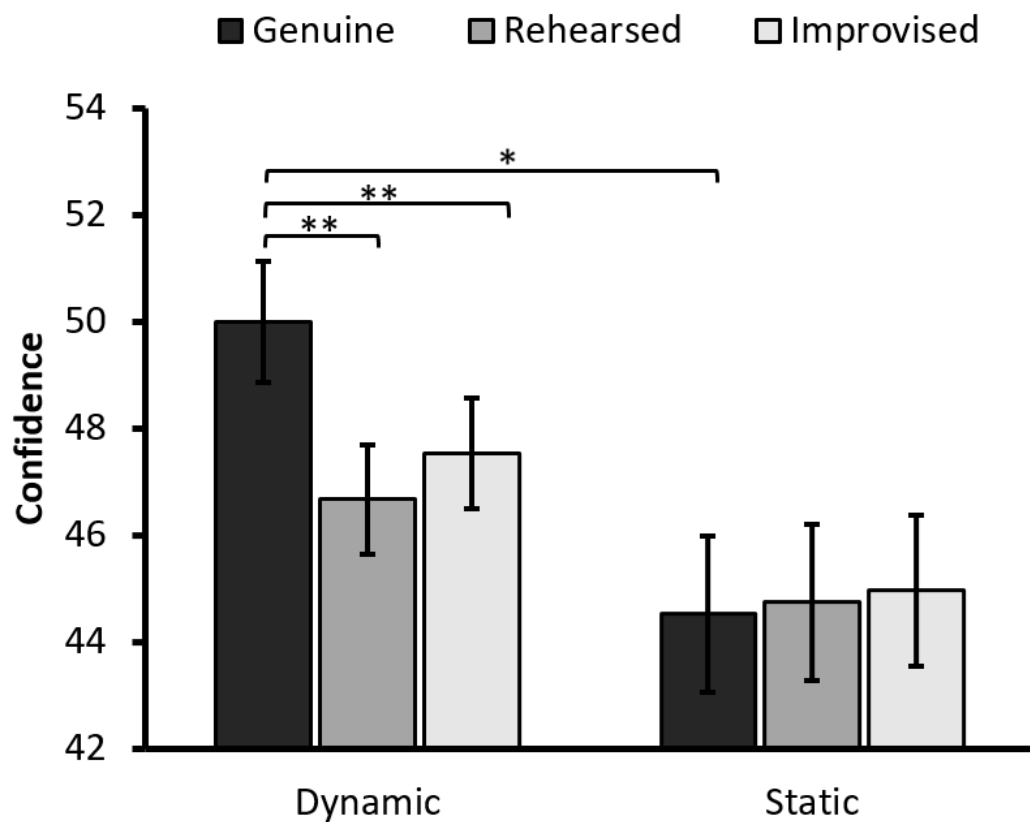
Static Condition

- Genuine < Improvised
- Genuine = Rehearsed
- Improvised > Rehearsed

Dynamic v Static

- $\text{Improvised}_{\text{STATIC}} > \text{Improvised}_{\text{DYNAMIC}}$

CONFIDENCE



Dynamic Condition

- Genuine > Rehearsed | Improvised
- Rehearsed = Improvised

Static Condition

- Genuine = Rehearsed = Improvised

Dynamic v Static

- Genuine > Genuine

FINDINGS

Accuracy: People are not great at discriminating dynamic expressions (60%)

And show an **authenticity bias** (assume most expressions are genuine)

Production Type matters: The type of deliberate expression affects (changes) judgement

Presentation Format matters: Expressions are judged differently if shown as static or dynamic stimuli

Now, imagine I didn't have 1 x study with 4 conditions x 2 formats; I could have run 8x 2-condition (genuine/fake) studies. Each findings conflicting and contradictory results! The research community would be confused...

IMPROVING EMOTION RESEARCH

WHAT CAUSED THIS?

- **Poor methodology**
 - Forced choice labels
 - Strong (unfounded and untested) assumptions
- **Lack of replication of core research and misinterpretation**
 - See Fridlund (1992; 1994)
- **Overreliance on pre-selected stimuli**
 - Turns emotion recognition into a “matching task”
- **Static and “prototypical” stimuli**
 - High intensity, clear, isolated, no contextual information, sole focus of task
- **Dichotomous thinking**
- **Incorrect analysis strategies**
 - No accounting for variability due to sender and receiver

frontiers
in Psychology

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Expression Authenticity: The Role of Genuine and Deliberate Displays in Emotion Perception

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People dedicate significant attention to others' facial expressions and to deciphering their meaning. Hence, knowing whether such expressions are genuine or deliberate is important. Early research proposed that authenticity could be discerned based on reliable facial muscle activations unique to genuine emotional experiences that are impossible to produce voluntarily. With an increasing body of research, such claims may no longer hold up to empirical scrutiny. In this article, expression authenticity is considered within the context of senders' ability to produce convincing facial displays that resemble genuine affect and human decoders' judgment of expression authenticity. This includes a discussion of spontaneous vs. posed expressions, as well as appearance- vs. elicitation-based approaches for defining emotion recognition accuracy. We further expand on the functional role of facial displays as neurophysiological states and communicative signals, thereby draw upon the encoding/decoding and affect induction perspectives of emotion expression. Theoretical and methodological issues are addressed with the aim to instigate great conceptual and operational clarity in future investigations of expression authenticity.

Keywords: emotion, facial expressions, genuine, posed and spontaneous, authenticity discrimination

OPEN ACCESS

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PERSPECTIVE

Darwin's illegitimate children: How body language experts undermine Darwin's legacy

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Abstract

The Expression of the Emotions in Man and Animals has received and continues to receive much attention from emotion researchers and behavioural scientists. However, the common misconception that Darwin advocated for the universality of emotional reactions has led to a host of unfounded and discredited claims promoted by ‘body language experts’ on both traditional and social media. These ‘experts’ receive unparalleled public attention. Thus, rather than being presented with empirically supported findings on non-verbal behaviour, the public is exposed to ‘body language analysis’ of celebrities, politicians and defendants in criminal trials. In this perspective piece, we address the misinformation surrounding non-verbal behaviour. We also discuss the nature and scope of statements from body language experts, unpacking the claims of the most viewed YouTube video by a body language expert, comparing these claims with actual research findings, and giving specific attention to the implications for the justice system. We explain how body language experts use (and misuse) Darwin's legacy and conclude with a call for researchers to unite their voices and work towards stopping the spread of misinformation about non-verbal behaviour.

Key words: body language expert; Darwin; emotions; facial expressions; misinformation; nonverbal behaviour

Social media summary: Self-proclaimed ‘body language experts’ often misinterpret and misuse Darwin's work on emotions and non-verbal behaviour.

The Expression of the Emotions in Man and Animals (Darwin, 1872) has received and continues to receive much attention from emotion researchers and behavioural scientists. Since the 1960s, the scientific community has produced tens of thousands of scientific publications on non-verbal behaviour, including facial expressions (Plasquellet & Denault, 2018). However, a common misconception is that Charles Darwin advocated for the universality of emotional reactions. In actuality, Darwin fully acknowledged cultural diversity (Darwin, 1871, 1872), and his work was not about emotions per se, but about states of mind – emotions being just one example of such states (e.g. disgust, anger, helplessness, patience, affirmation, negation; Fridlund & Russell, in press). Hinde (1985) suggested that the title of Darwin's book might have added to this confusion, leading many astray.

More specifically, although he wrote that ‘the same state of mind is expressed throughout the world with remarkable uniformity’ (Darwin, 1872: 17), Darwin did not posit that facial expressions were universal. This claim was made by Sylvan Tomkins in the 1950s and 1960s (Tomkins, 1962, 1963). Darwin also did not assert that facial expressions evolved for a communicative purpose (Russell & Fernandez-Dols, 1997). Instead, he argued for the opposite position (Burkhardt, 1985). According



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OPERATIONAL DEFINITIONS

Defining your estimand & effects

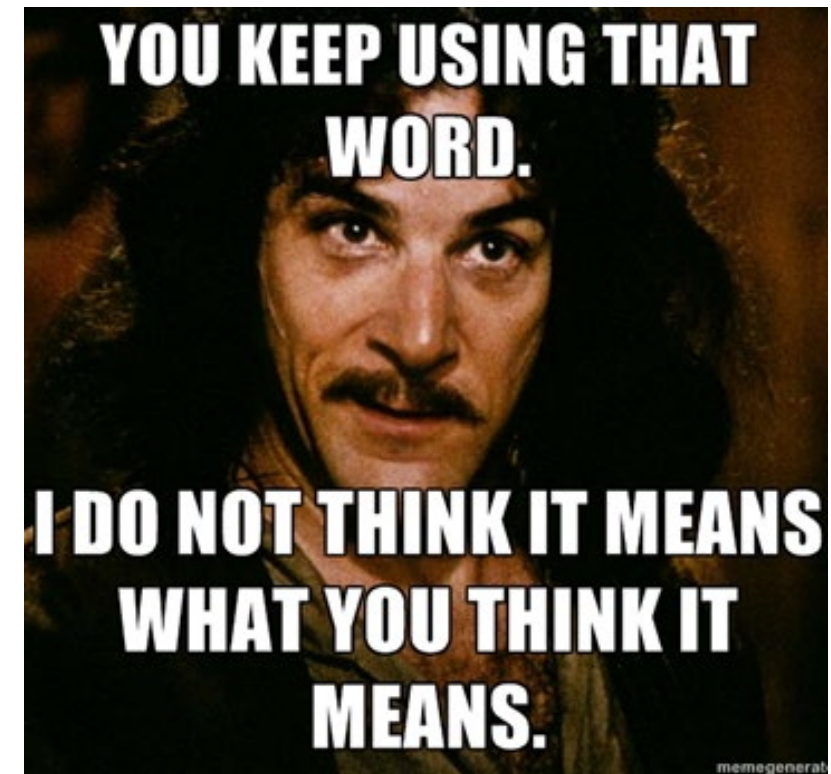
- posed / deliberate / fake / deceptive / voluntary / non-genuine
- *emotion identification, categorization, discrimination, inference, and recognition*
- Different terms for same thing & same term for different things

Zloteanu et al., (2020, 2018)

- **emotion classification accuracy** is the ability to infer specific emotions from facial displays
- **emotion authenticity discrimination** as the ability to differentiate between spontaneous (genuine) and posed (deliberate) displays.





Buck et al. (2017)

- use the exact opposite definitions which they label **emotion categorization ability** and **emotion communication accuracy**.







BETTER MODELS: MIXED EFFECTS MODELS

ANOVAs treat all Trials/Senders as equivalent, but:

Video 1	Video 2	Video 3	Video 4
			

Not all the same, regardless of labels

ANOVAs treat all Participants as homogenous, but:

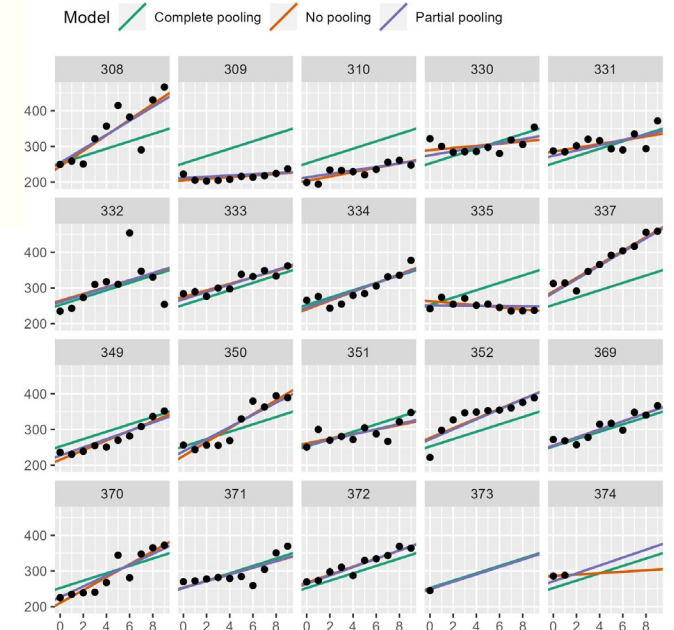
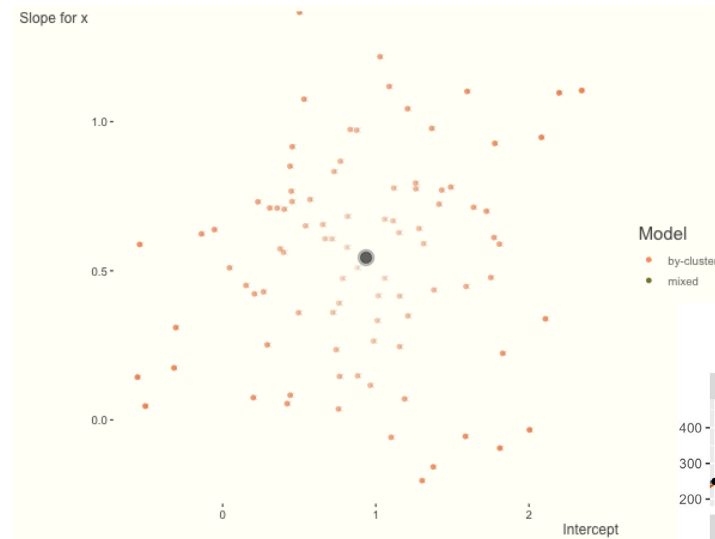
P 1	P 2	P 3	P 4
			

All response differences are ignored

WE CAN DO BETTER: BAYESIAN MIXED EFFECTS MODELS

Advantages over RM-ANOVA

- Same results as ANOVA analyses
- All data types permitted
- Complex designs
- Missing data
- Differing number of repeats (unbalanced data)



STREAMLINE OUR ANALYSES: 1 (SDT) MODEL!

<https://doi.org/10.13140/RG.2.2.24441.13926> for Talk
<https://osf.io/abts4/> for R script

Accuracy %

Cases	Sum of Squares	df	Mean Square	F	p
Veracity	74.413	1	74.413	<.001	
Veracity * Condition	0.511	2	0.256	0.602	
Residuals		103			

Note. Type III Sum of Squares

Cases	Sum of Squares	df	Mean Square	F	p
Condition	5.230	2	2.615	1.700	0.188
Residuals	3.076	103			

Note. Type III Sum of Squares

SDT – Accuracy (%)

Cases	Sum of Squares	df	Mean Square	F	p
Condition	0.102	2	0.051	1.433	0.243
Residuals	3.655	103			

Note. Type III Sum of Squares

SDT – Bias (c)

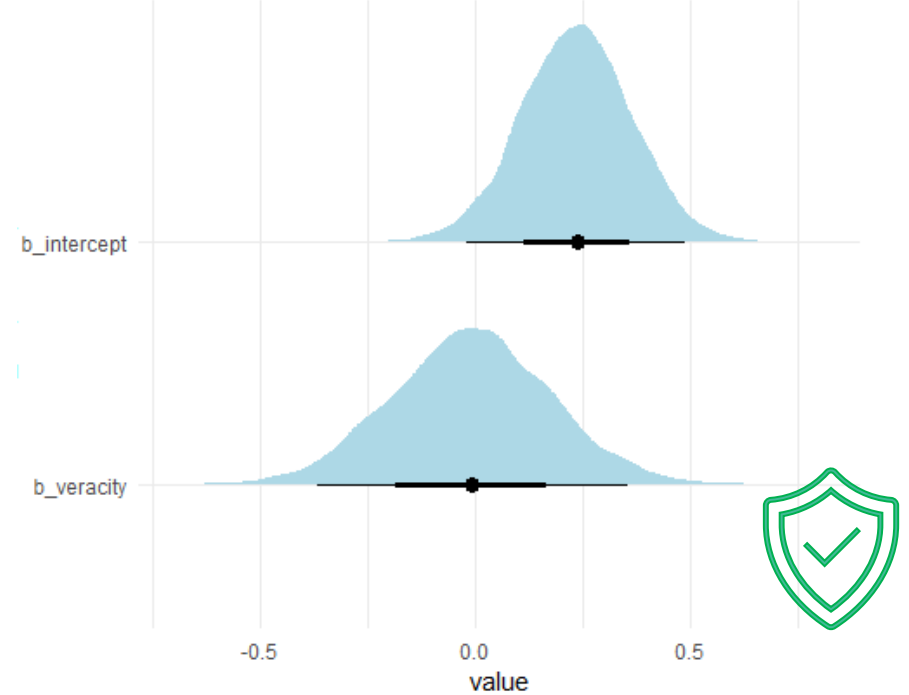
Cases	Sum of Squares	df	Mean Square	F	p
Condition	8.600	2	4.300	0.511	0.602
Residuals	1734.53	103	16.840		

Note. Type III Sum of Squares

SDT – Bias (c)

Cases	Sum of Squares	df	Mean Square	F	p
Condition	0.135	2	0.068	0.617	0.541
Residuals	13.906	103			

Note. Type III Sum of Squares



```
Summary of Posterior Distribution
```

Parameter	Median	95% CI	pd	ROPE	% in ROPE
(Intercept)	0.24	[-0.02, 0.49]	96.53%	[-0.10, 0.10]	12.47%
veracity	-6.44e-03	[-0.37, 0.36]	51.32%	[-0.10, 0.10]	44.58%

EXAMPLE FOR "ACCURACY": PROBIT MODELS

Data Preparation

Long format

	A	B	C	D	E
1	Participant	Stimuli	Veracity	Answer	Condition
2	1	video1L	1	1	ERT
3	1	video2L	0	0	ERT
4	1	video3T	0	1	ERT
5	1	video4T	1	1	ERT
6	2	video1L	0	0	BT
7	2	video2L	0	1	BT
8	2	video3T	1	1	BT
9	2	video4T	0	1	BT
10	3	video1L	0	1	CT
11	3	video2L	1	0	CT
12	3	video3T	0	1	CT
13	3	video4T	1	1	CT

Truth = 1
Lie = 0

Bayesian Priors

As the probit CDF back-transforms to a Z-curve, we can see the parameter space the same as a Normal distribution with mean = 0, and SD = 1.

So, think in terms of Cohen's d!

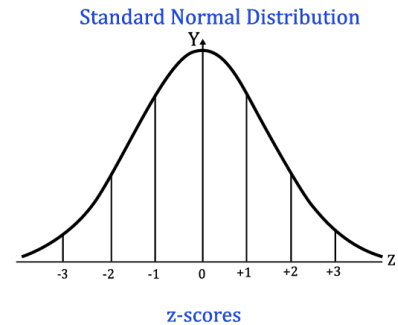
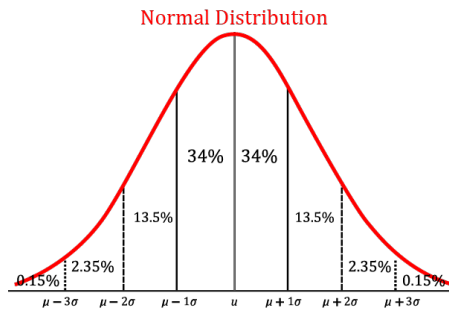
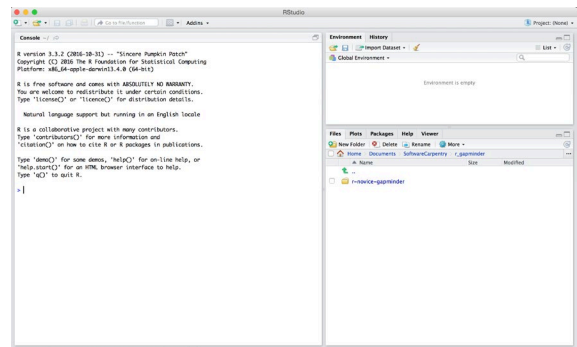
Some acceptable priors for the coefficients is $N \sim (0,1)$

But, avoid being too specific for interactions.

Note, overall priors matter most of *model convergence* issues or computing *Bayes Factors*

R package

```
library(brms)
library(bayestestR)
library(emmeans)
```



PROBIT MODELS

Syntax

```
m1 <- brm(Answer ~ 1 + Veracity + (1 + Veracity | Participant) + (1 | Stimuli),
  data = my_data,
  family = bernoulli(link = probit)
)
```

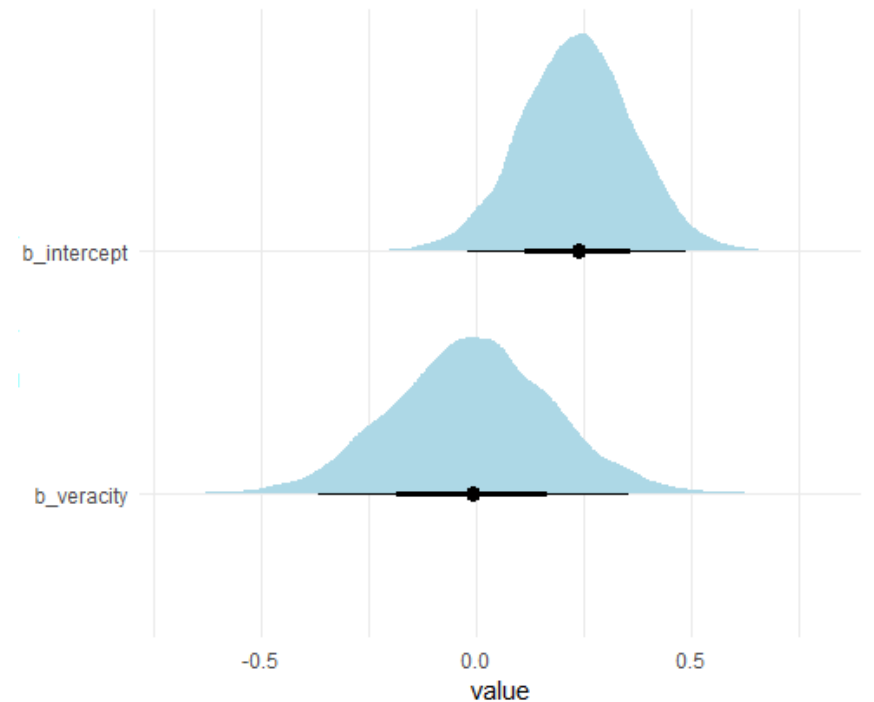
-C

d'

Participant variance

Video variance

Plots



Output

Summary of Posterior Distribution

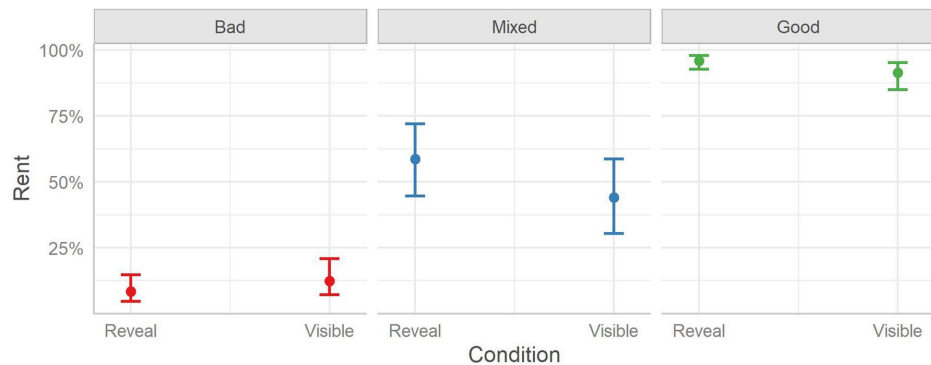
Parameter	Median	95% CI	pd	ROPE	% in ROPE
(Intercept)	0.24	[-0.02, 0.49]	96.53%	[-0.10, 0.10]	12.47%
Veracity	-6.44e-03	[-0.37, 0.36]	51.32%	[-0.10, 0.10]	44.58%

ALL DATA-TYPES WELCOME!

Categorical

Syntax

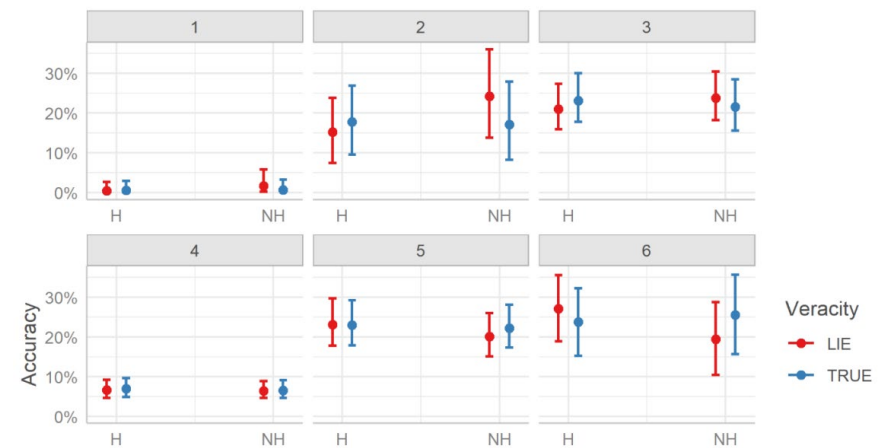
```
m2 <- brm(Answer ~ 1 + Veracity + (1 + Veracity | Participant)
+ (1 | Stimuli),
  data = my_data,
  family = categorical()
)
```



Ordinal (Likert, scale)

Syntax

```
m3 <- brm(Answer ~ 1 + Veracity + (1 + Veracity | Participant)
+ (1 | Stimuli),
  data = my_data,
  family = cumulative()
)
```



OPEN SCIENCE

OPEN RESEARCH

Reproducible

- Share your analysis code

Open

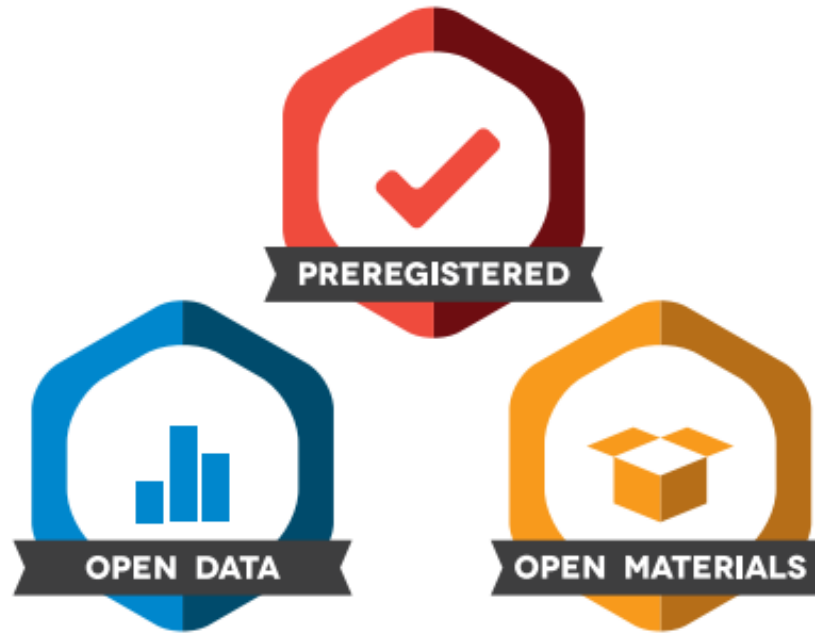
- Make your data public
- Share your videos!!!

Interpretable

- Use estimation language
- Report effect sizes in different ways
- Plot your data

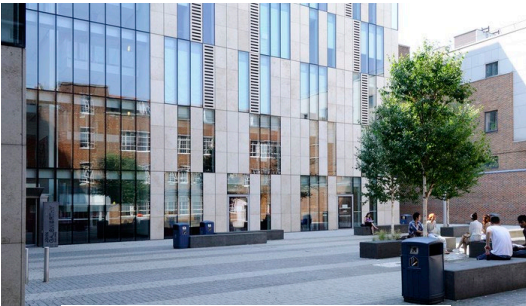
Transparent

- Pre-register your study!
- Differentiate Planned from Exploratory analyses



SHARING IS CARING (AND NECESSARY FOR SCIENTIFIC INTEGRITY)

LAB 1



There IS a difference & it's POSITIVE!

LAB 2



There's NO difference!

LAB 3



There IS a difference & but it's NEGATIVE

MANY FACES PROJECT

**A big team science approach
to face perception and
recognition**

<https://osf.io/ngjq7/>



TAKE AWAY MESSAGES

FINAL THOUGHTS

Pick a framework (or invent your own)

Be specific on what you believe – what are your assumptions?

Figure out what effects in your area look like and what you expect to find

Make specific, testable, and falsifiable predictions (see also *severe testing*)

Share your data, code, stimuli, papers

Engage in debates and discussions

Don't be afraid to be wrong!

(oh, and use Bayesian Mixed effects models!)

THANK YOU!

QUESTIONS?

Contact

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🌐 : mz555.github.io

