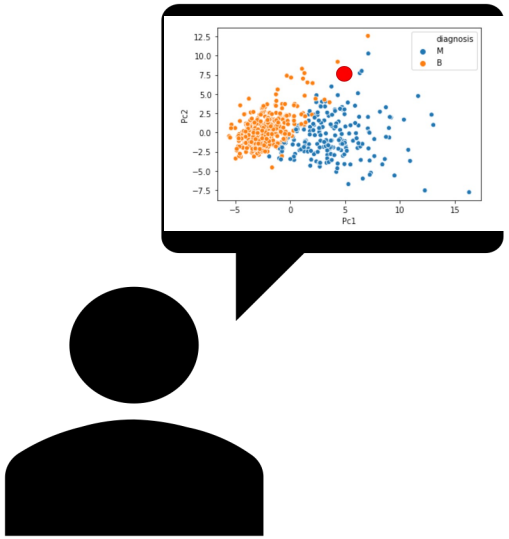
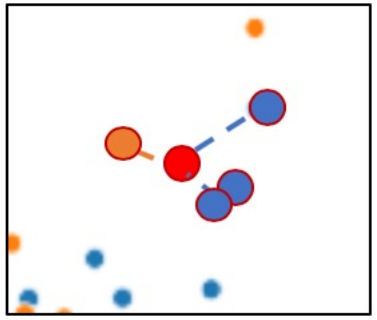
Appendix in Cross Validation

A refined and fun analogy to understand cross validation

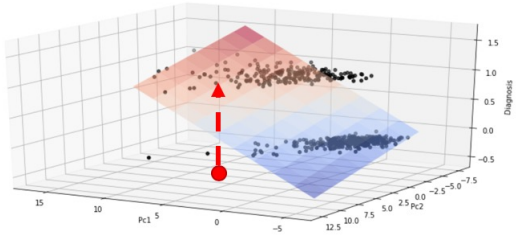
Why do we need cross validation?



Why do we need cross validation?

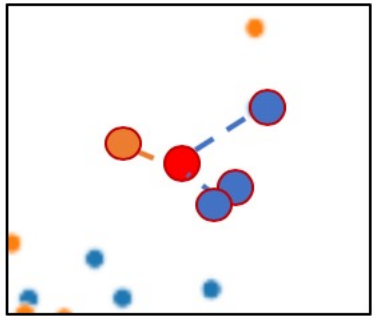


How many neighbors?

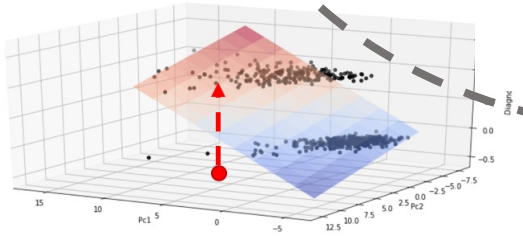


How many features?
What regularization?

Why do we need cross validation?



How many neighbors?



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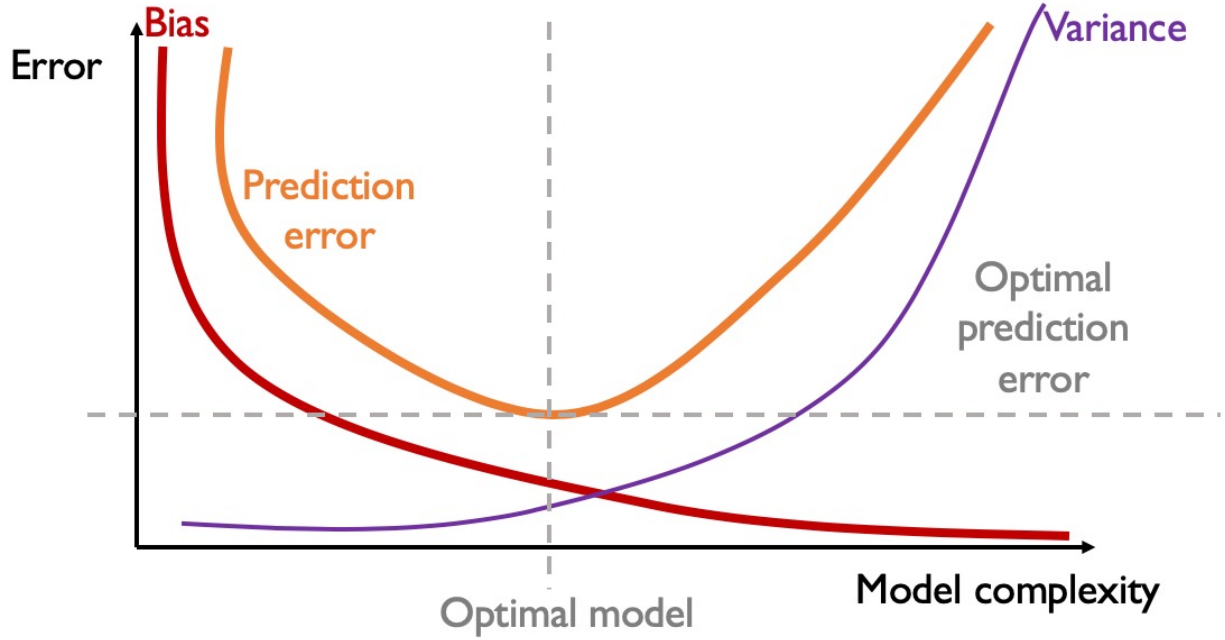

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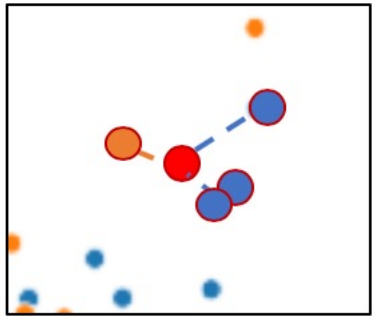
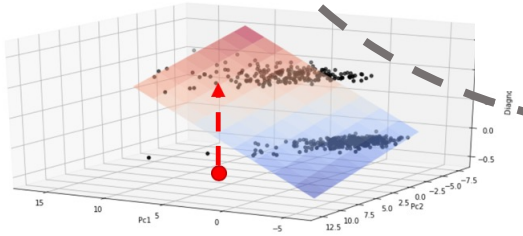


How many neighbors?



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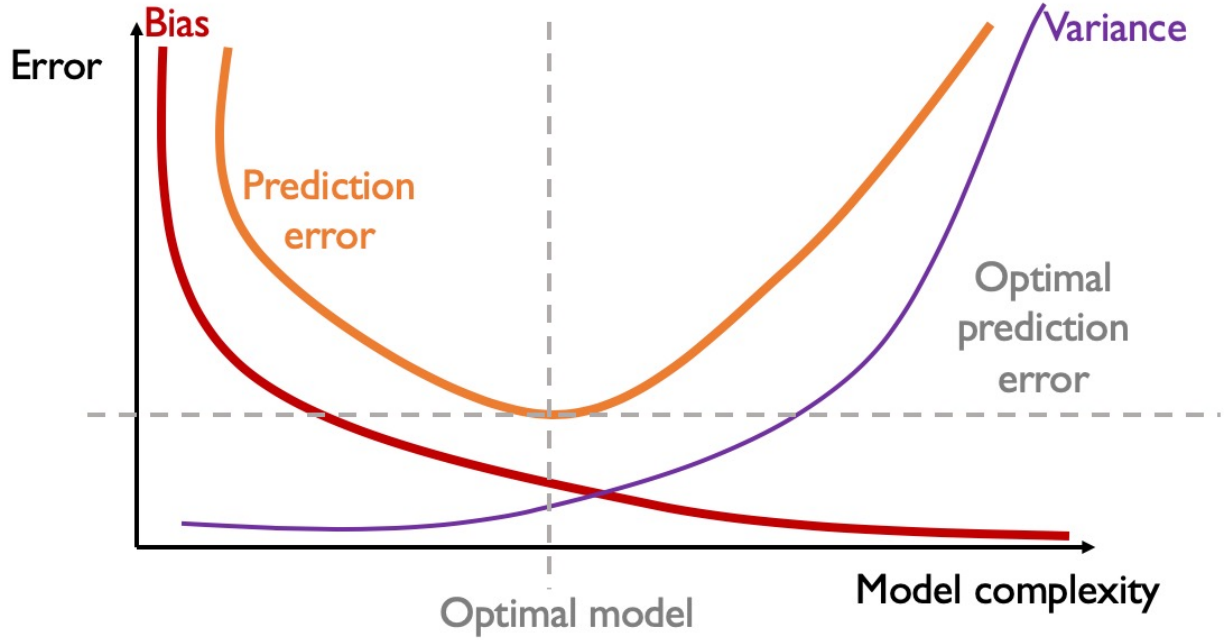
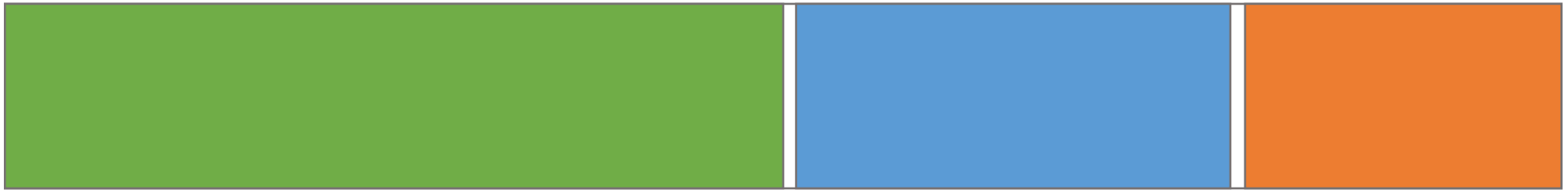


Cross Validation = Create Prediction error curve

How to estimate prediction error?

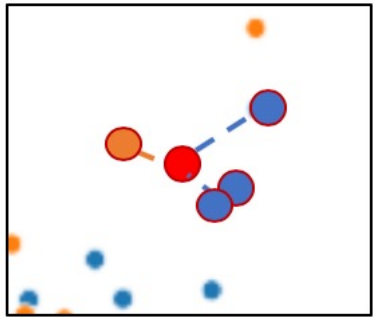
We need to generalize to **unseen** data

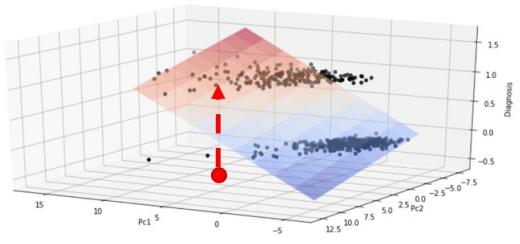
Your data



Train

Fit the models





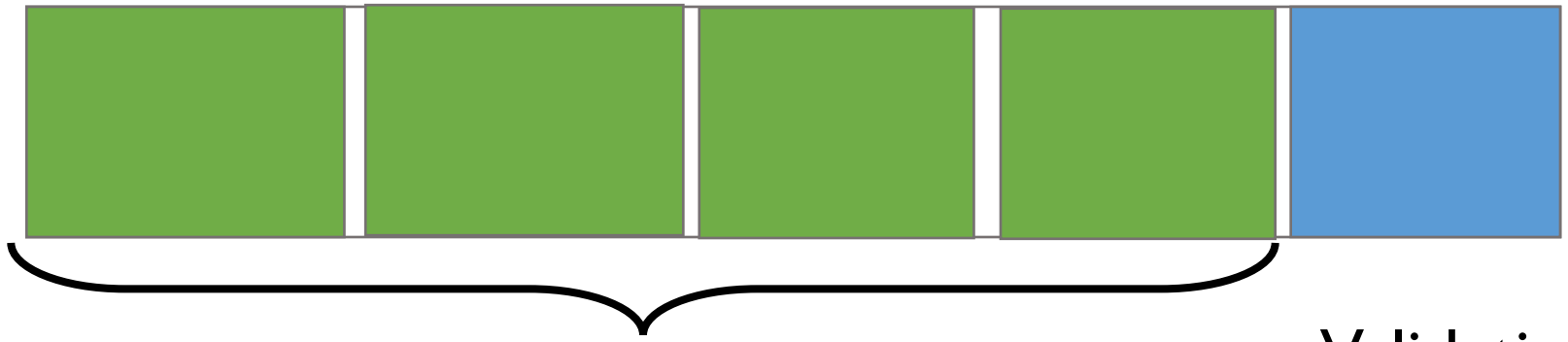
Validation

Create prediction error curve during **model selection**

Test

Create **final assessment** of prediction error curve for **chosen** model

K-fold Cross validation



Train

Fit the models

Validation

Compute prediction error

$$Err_5 = \sum_{i \in S_5} \left(y^{(i)} - \hat{f}_5 \left(x^{(i)} \right) \right)^2$$

K-fold Cross validation

$$Err_4 = \sum_{i \in S_4} \left(y^{(i)} - \hat{f}_4 \left(x^{(i)} \right) \right)^2$$

$$Err_3 = \sum_{i \in S_3} \left(y^{(i)} - \hat{f}_3 \left(x^{(i)} \right) \right)^2$$

$$Err_2 = \sum_{i \in S_2} \left(y^{(i)} - \hat{f}_2 \left(x^{(i)} \right) \right)^2$$

$$Err_1 = \sum_{i \in S_1} \left(y^{(i)} - \hat{f}_1 \left(x^{(i)} \right) \right)^2$$

K-fold Cross validation

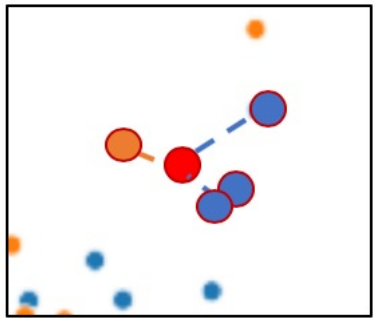
$$Err = \frac{1}{5}(Err_1 + Err_2 + Err_3 + Err_4 + Err_5)$$

K-fold Cross validation

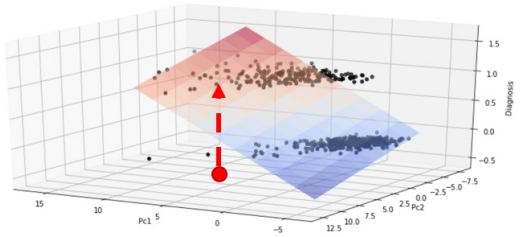
$$Err = \frac{1}{5}(Err_1 + Err_2 + Err_3 + Err_4 + Err_5)$$

Model

Average prediction error



Err_{KNN}



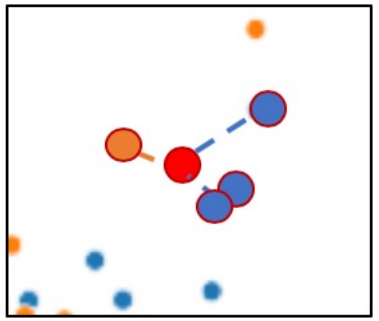
Err_{LR}

K-fold Cross validation

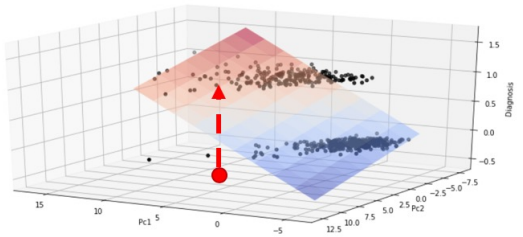
$$Err = \frac{1}{5}(Err_1 + Err_2 + Err_3 + Err_4 + Err_5)$$

Model

Average prediction error



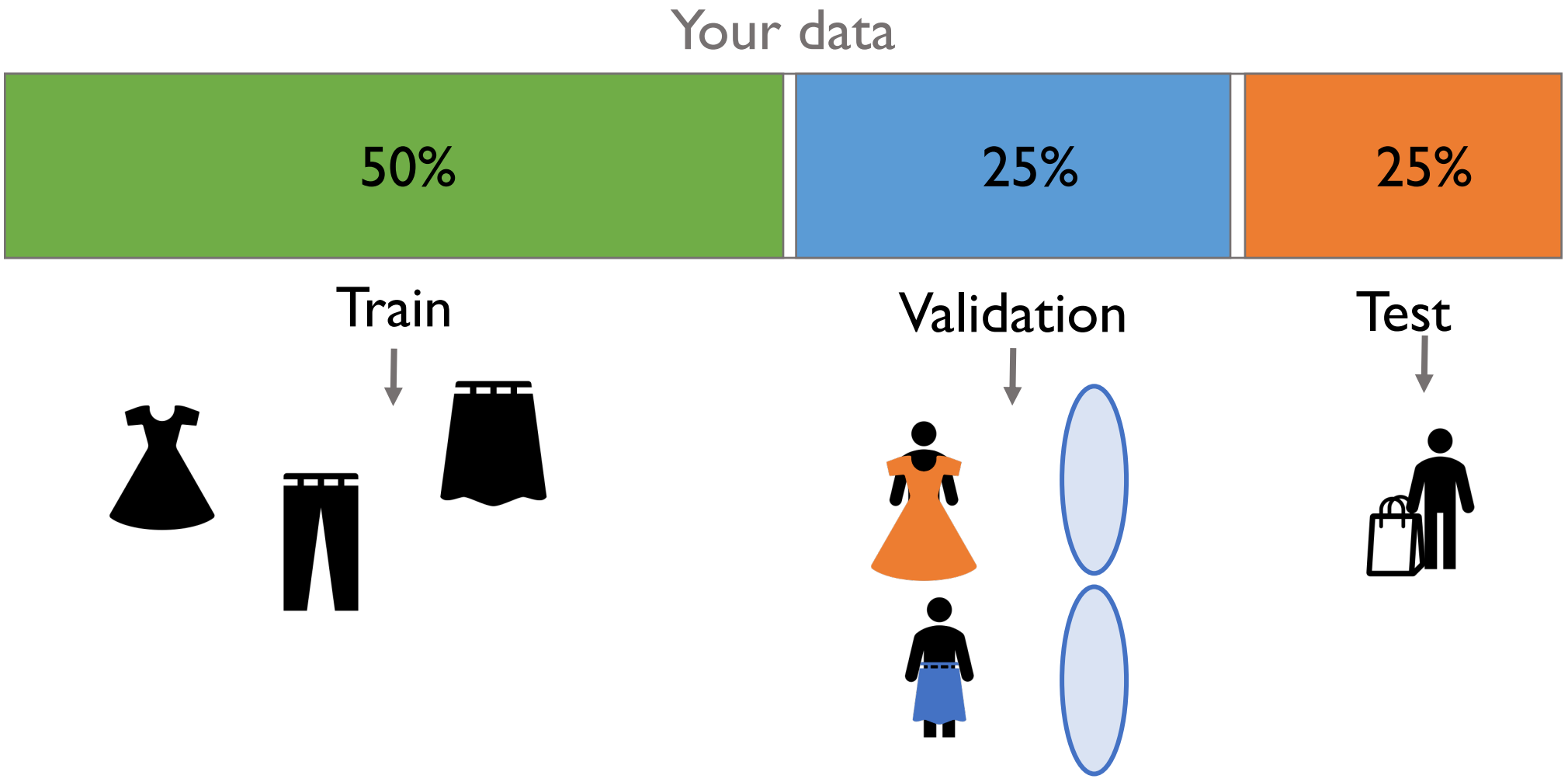
Err_{KNN}



Err_{LR}

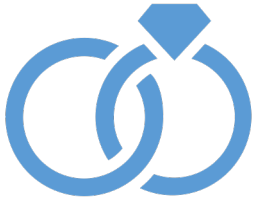
How to estimate prediction error?

We need to generalize to **unseen** data



Refined Analogy for Train, Validation and Test

Refined Analogy for Train, Validation and Test

Say *yes* to the DRESS 

Training	Validation	Test

Bride

Refined Analogy for Train, Validation and Test

Say *yes* to the DRESS

Training	Validation	Test

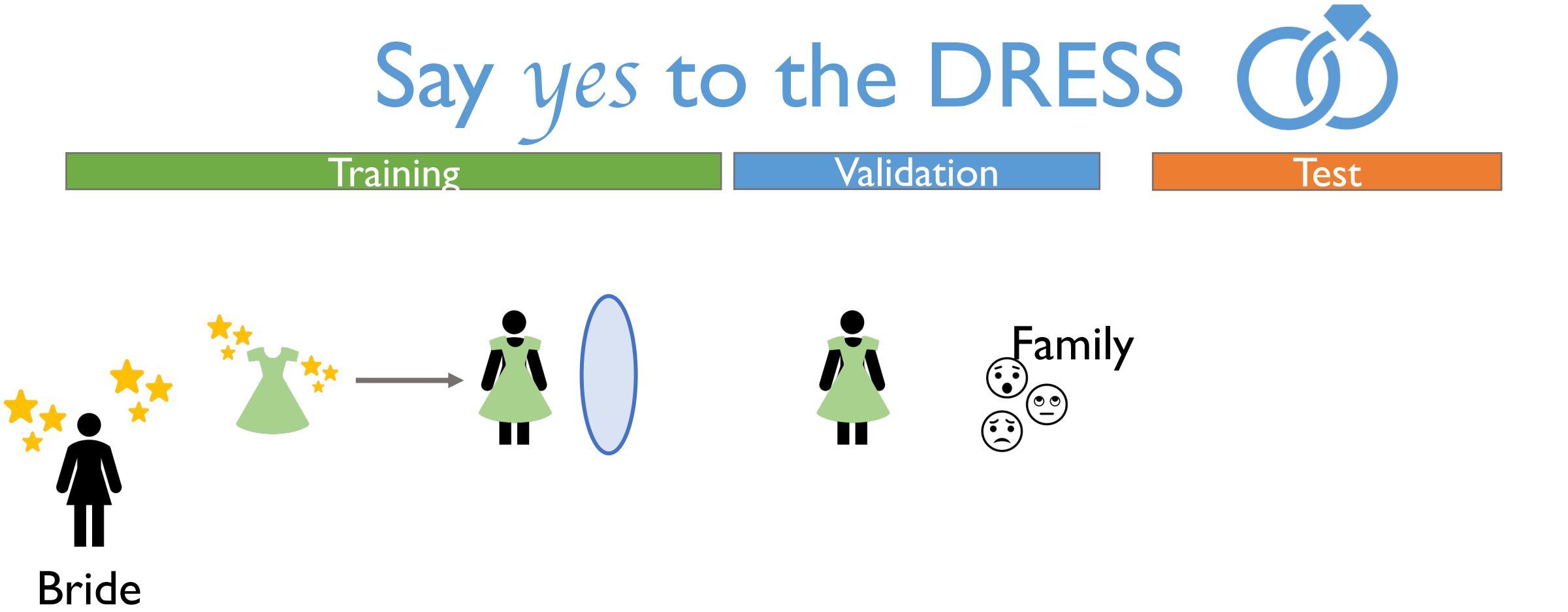
Bride

Refined Analogy for Train, Validation and Test

Say *yes* to the DRESS

Bride

Refined Analogy for Train, Validation and Test



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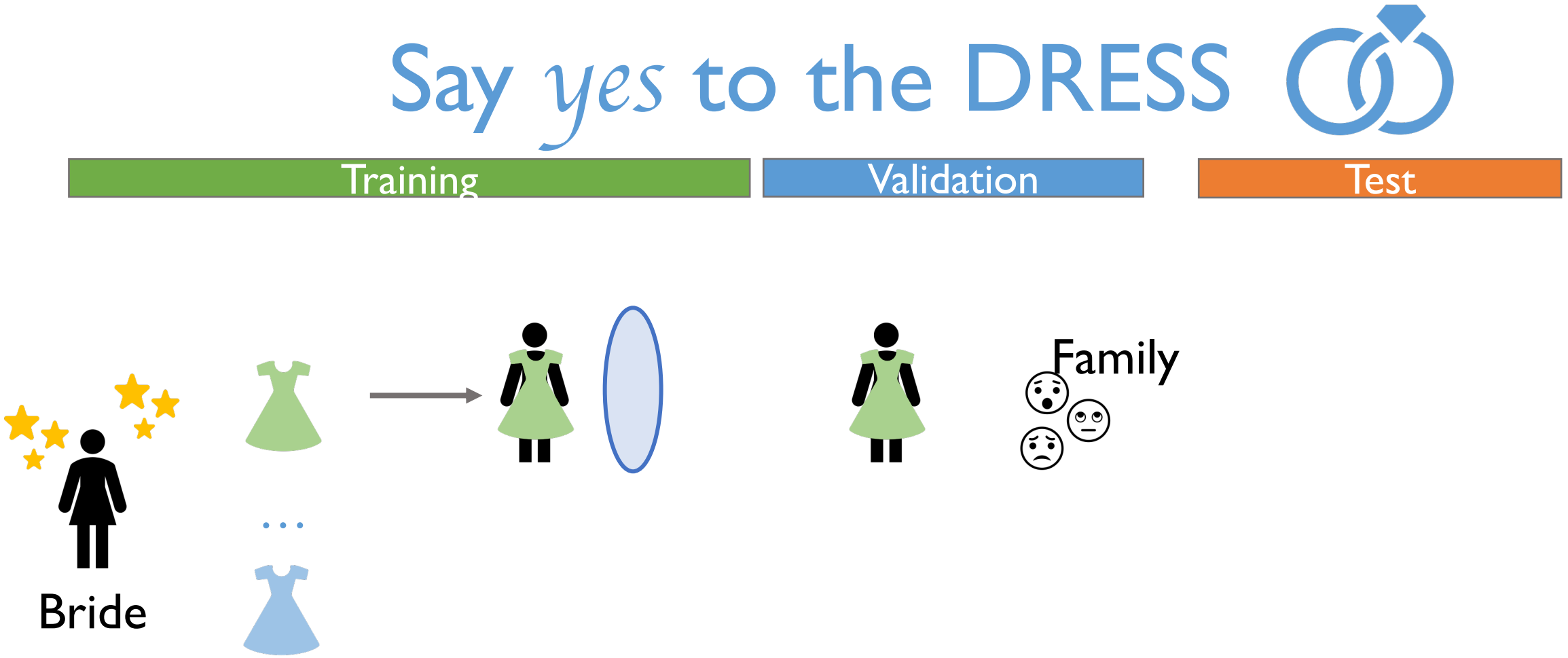

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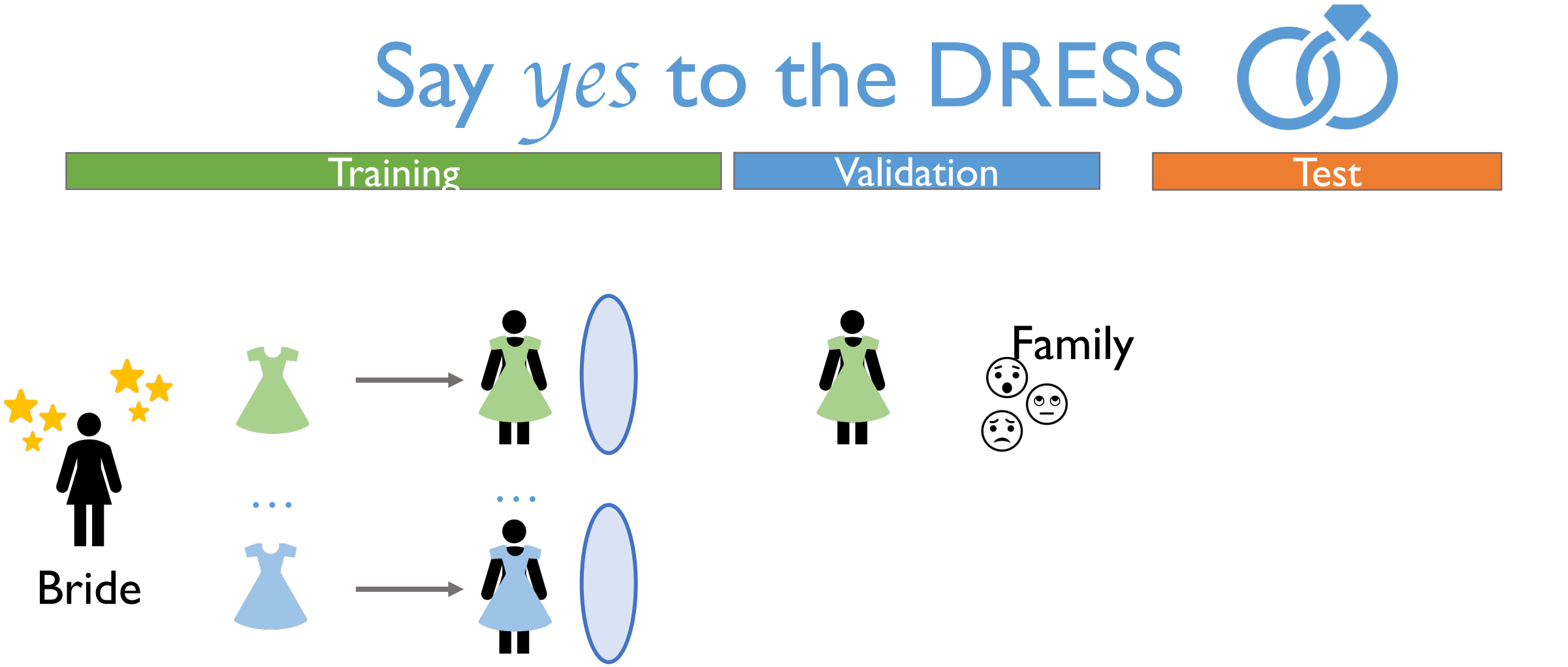

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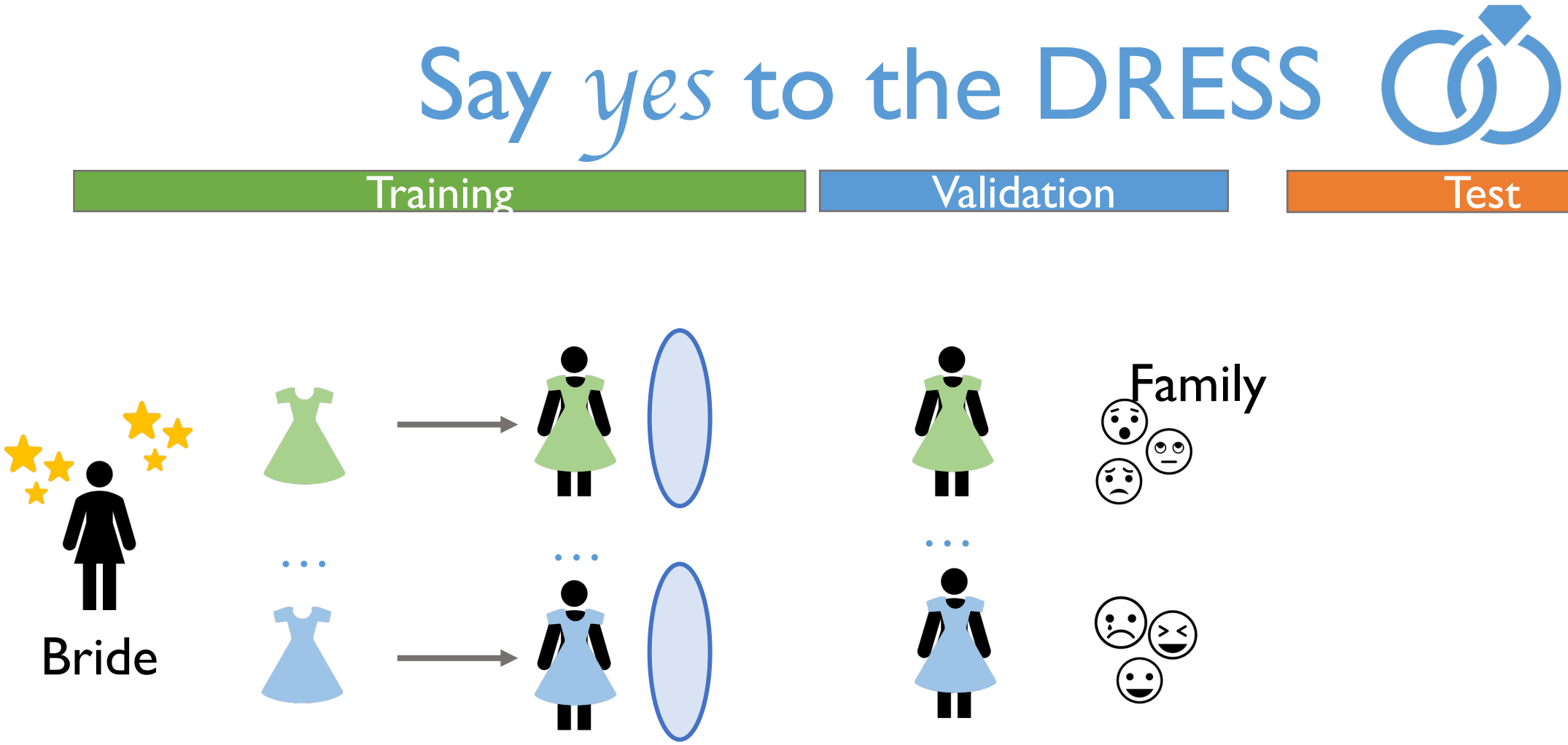

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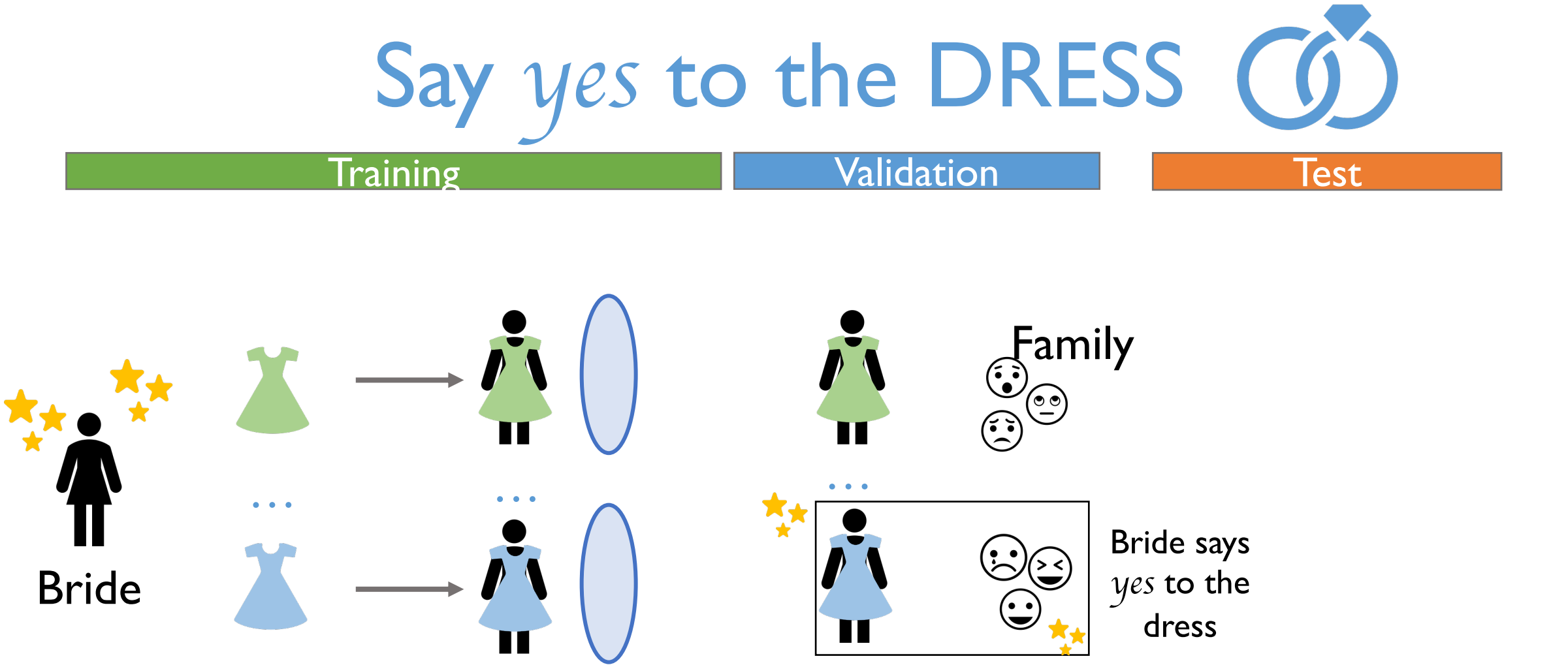
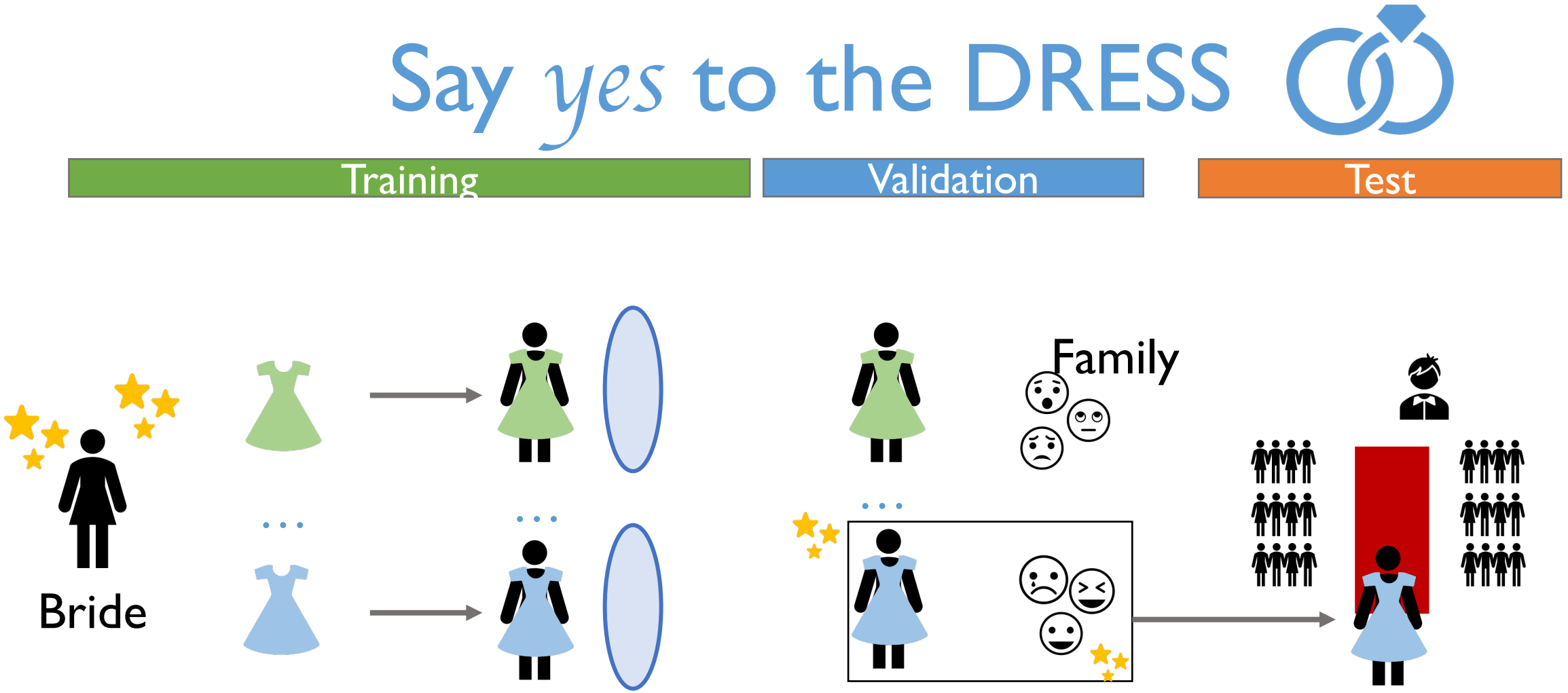
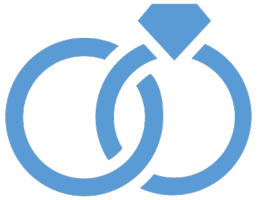


Refined Analogy for Train, Validation and Test



Refined analogy for Cross-Validation

Say *yes* to the DRESS 

Training	Validation	Test

Refined analogy for Cross-Validation

Say *yes* to the DRESS

Bridesmaids *edition*

Training	Validation	Test

Refined analogy for Cross-Validation

Say *yes* to the DRESS

Bridesmaids *edition*

Training	Validation	Test

Refined analogy for Cross-Validation

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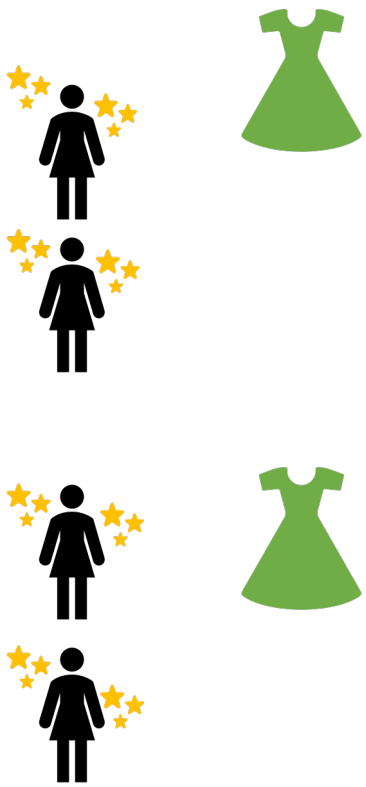
Bridesmaids edition

Training	Validation	Test



Refined analogy for Cross-Validation

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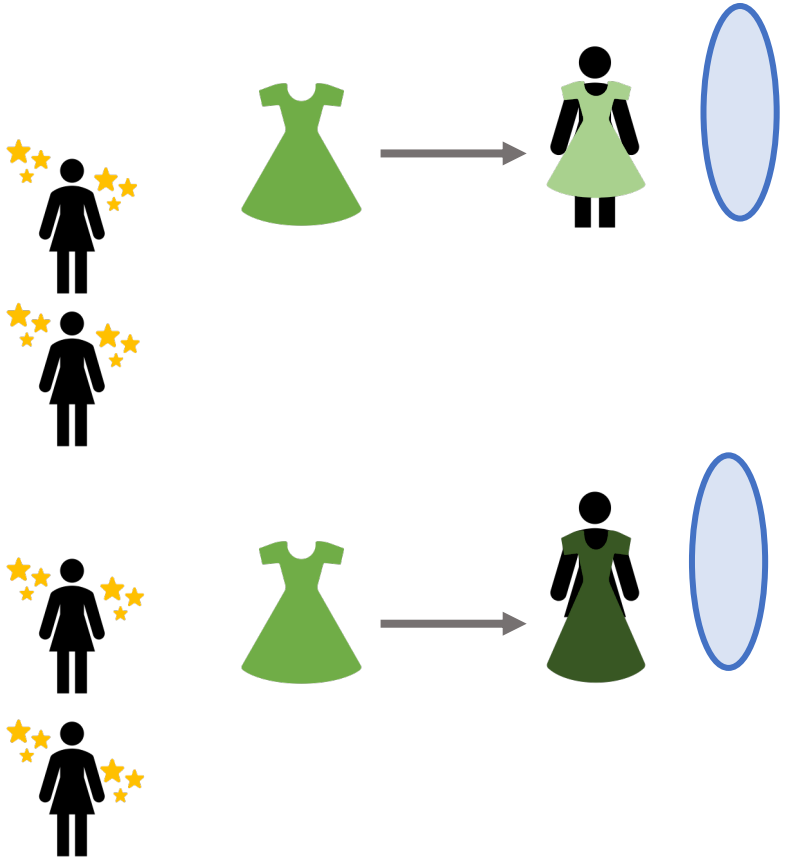
Bridesmaids *edition*

Training	Validation	Test



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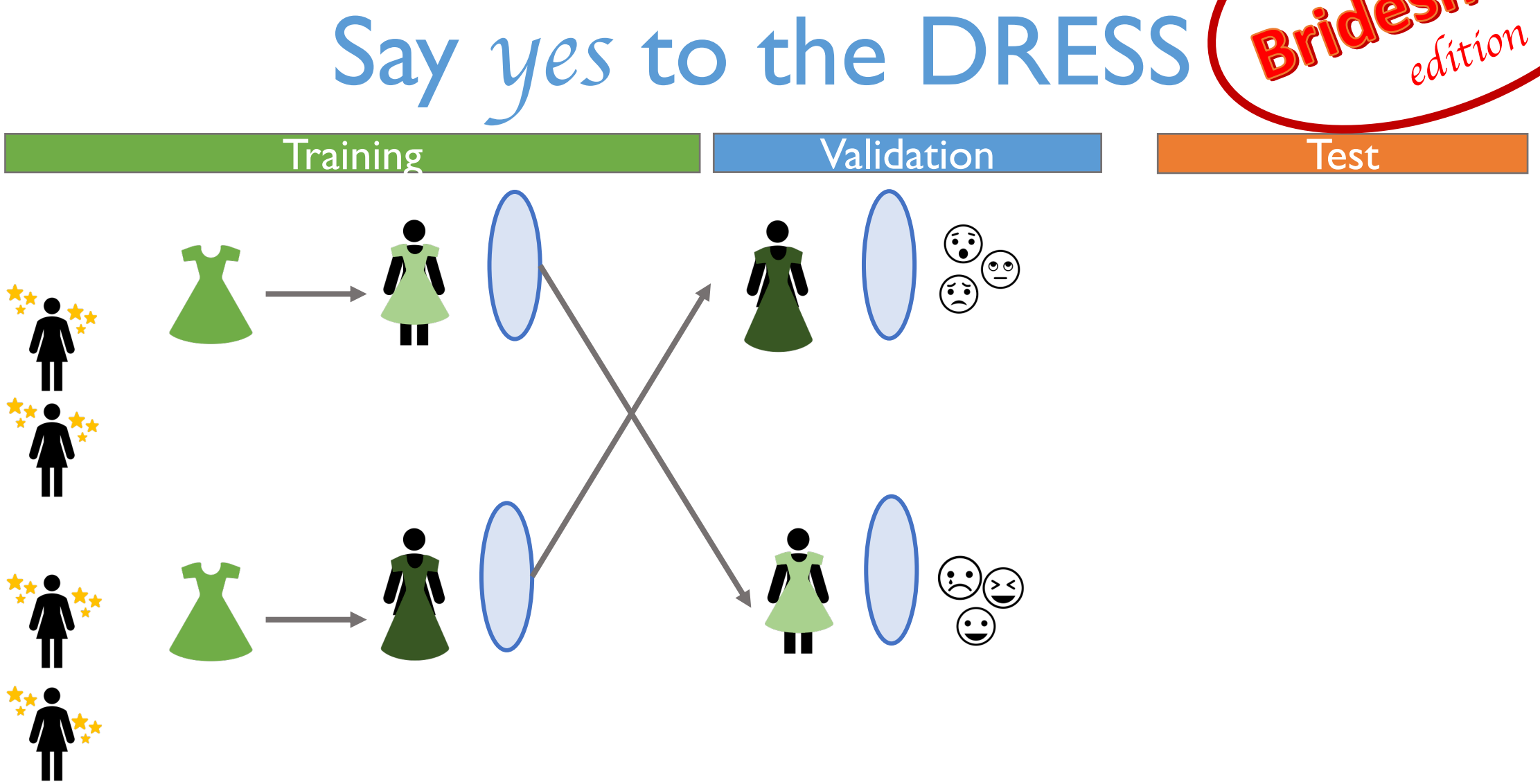
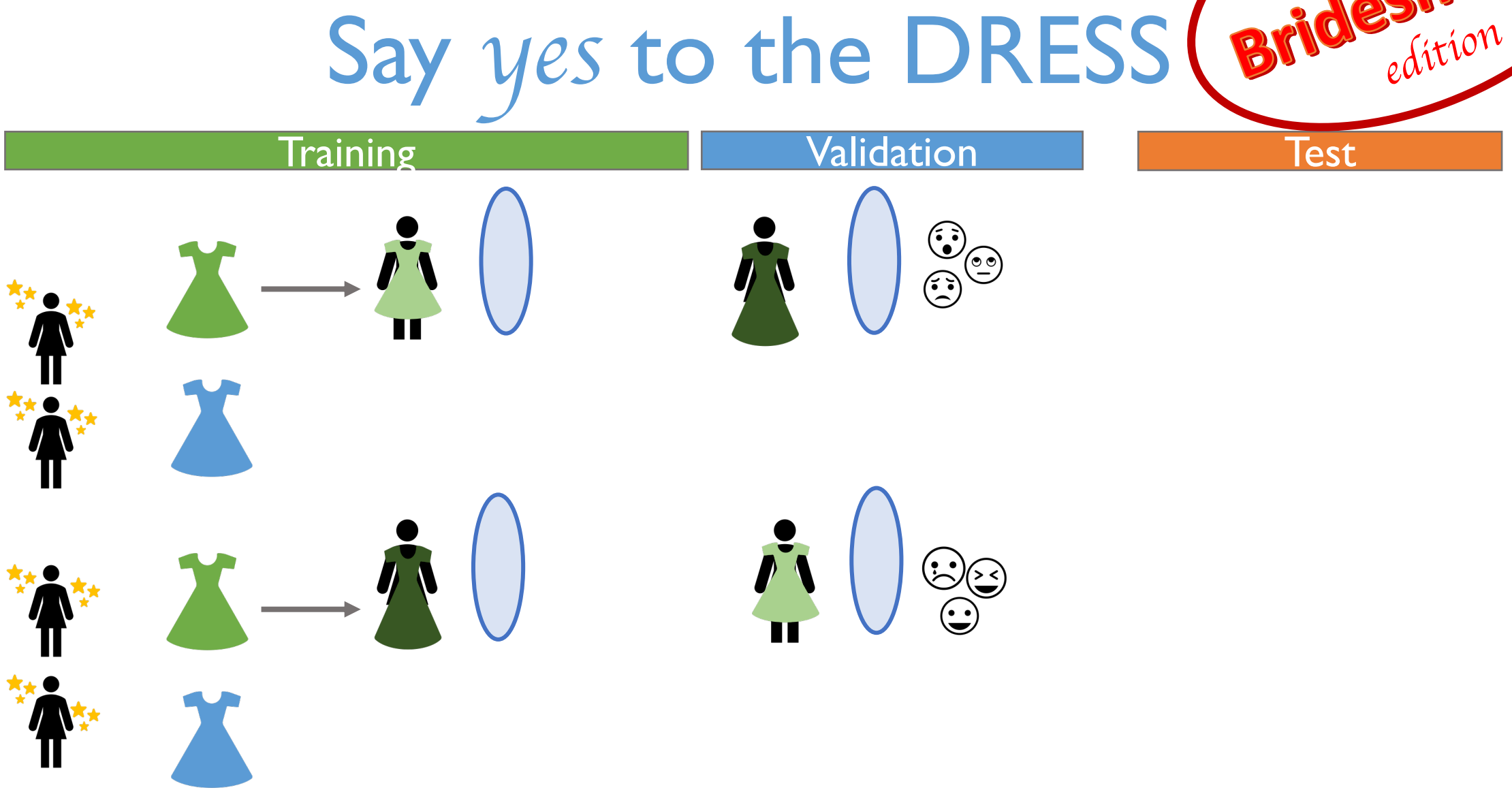


Refined analogy for Cross-Validation



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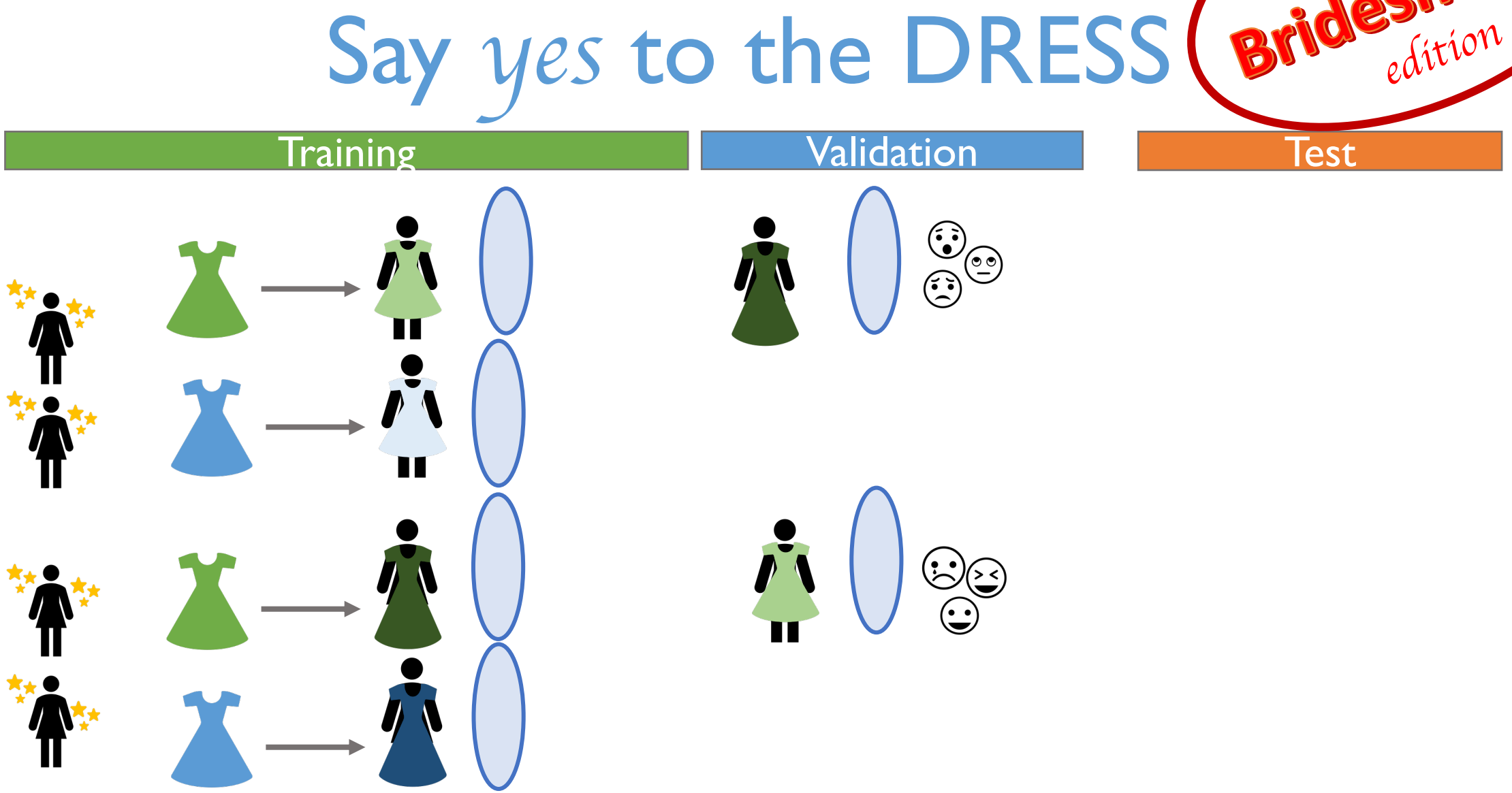

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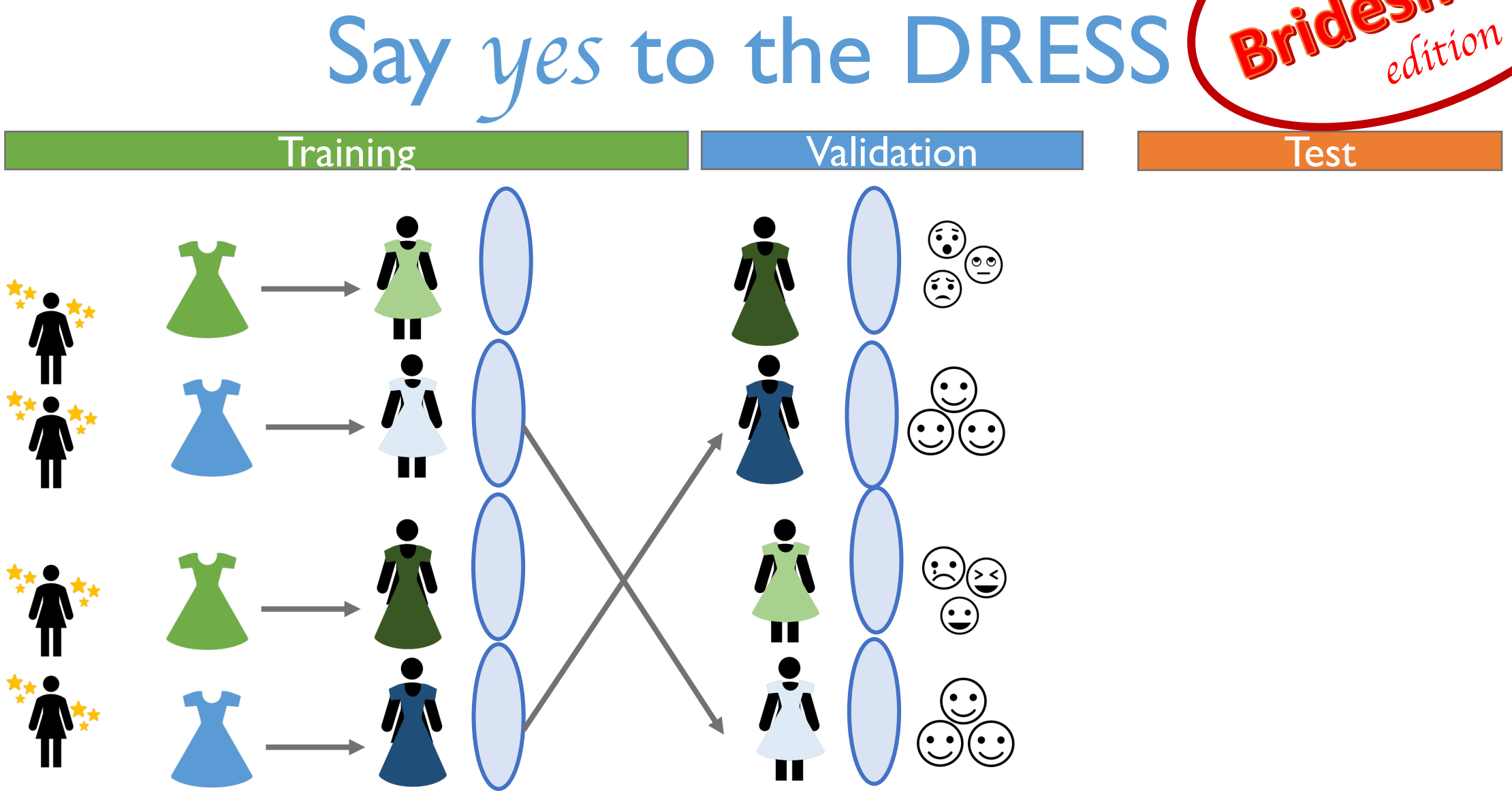

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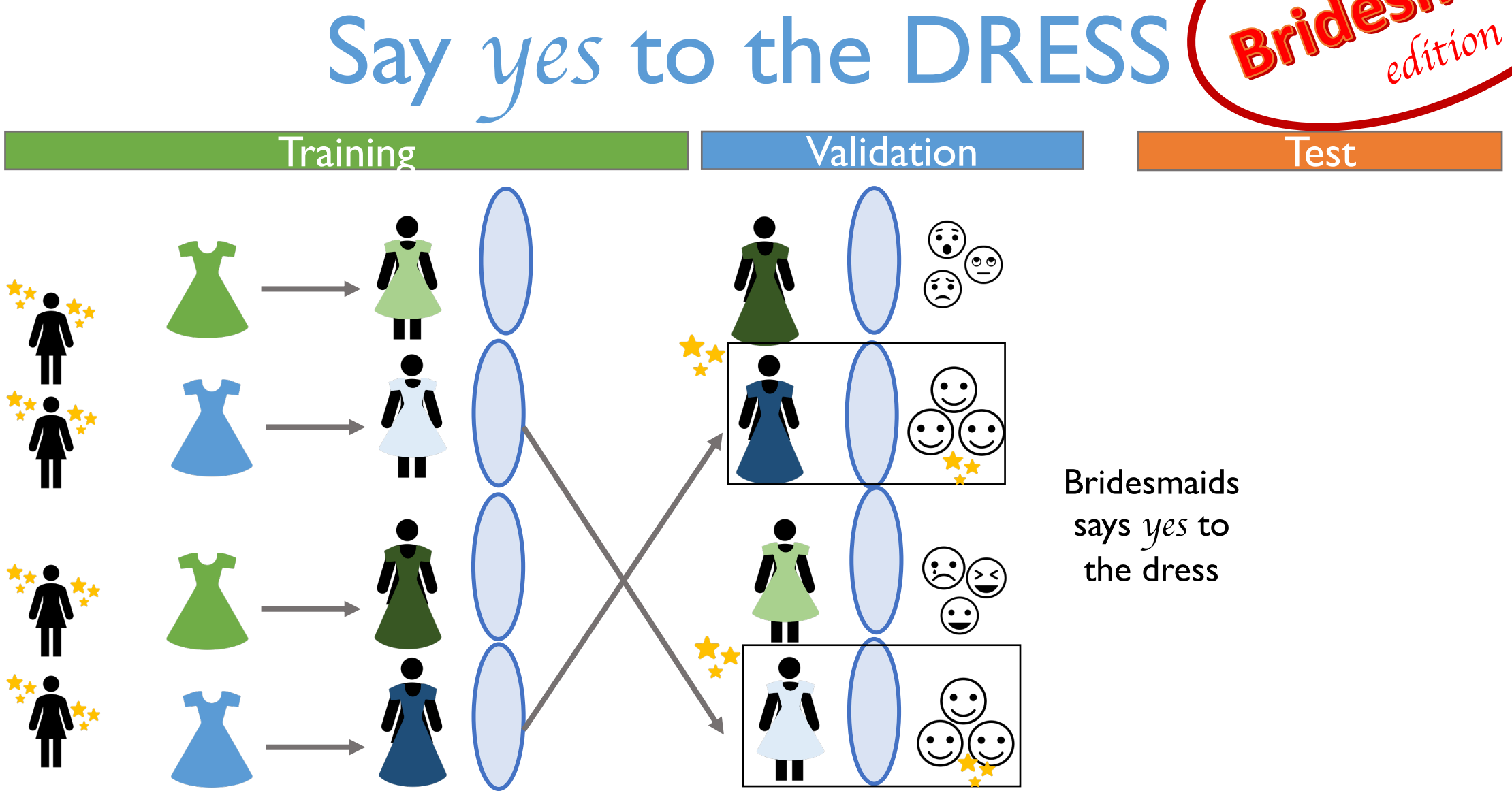

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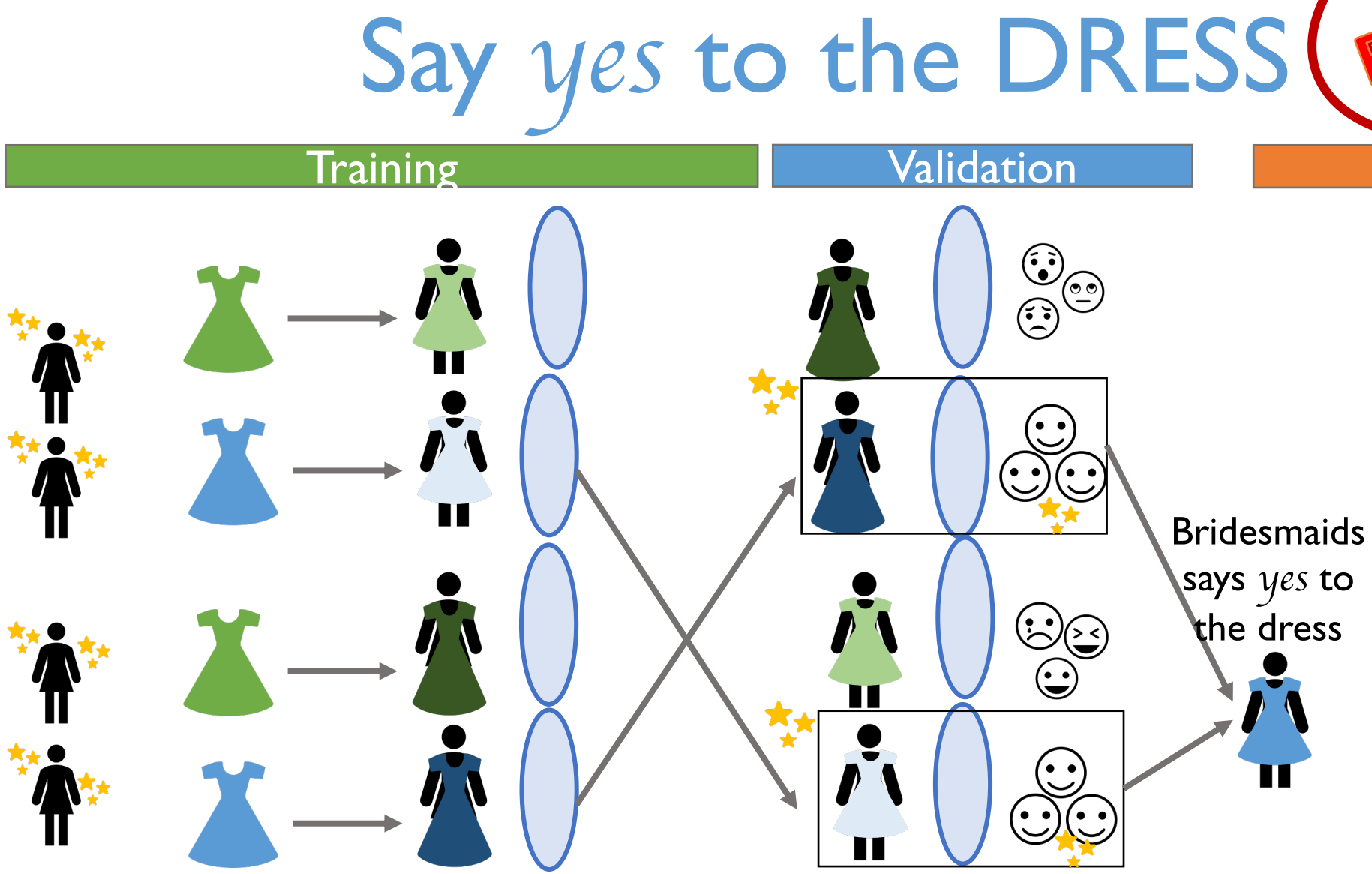

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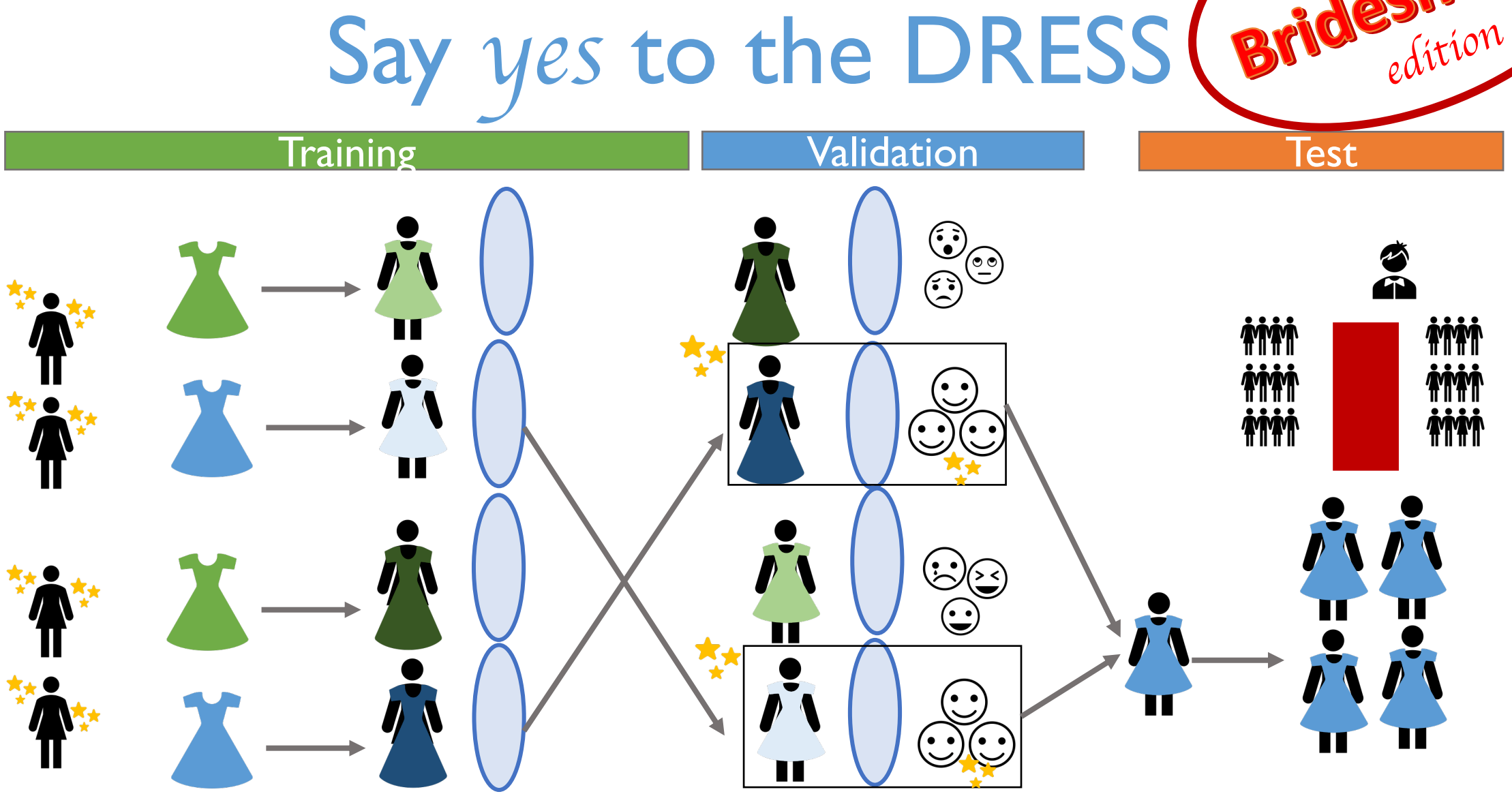

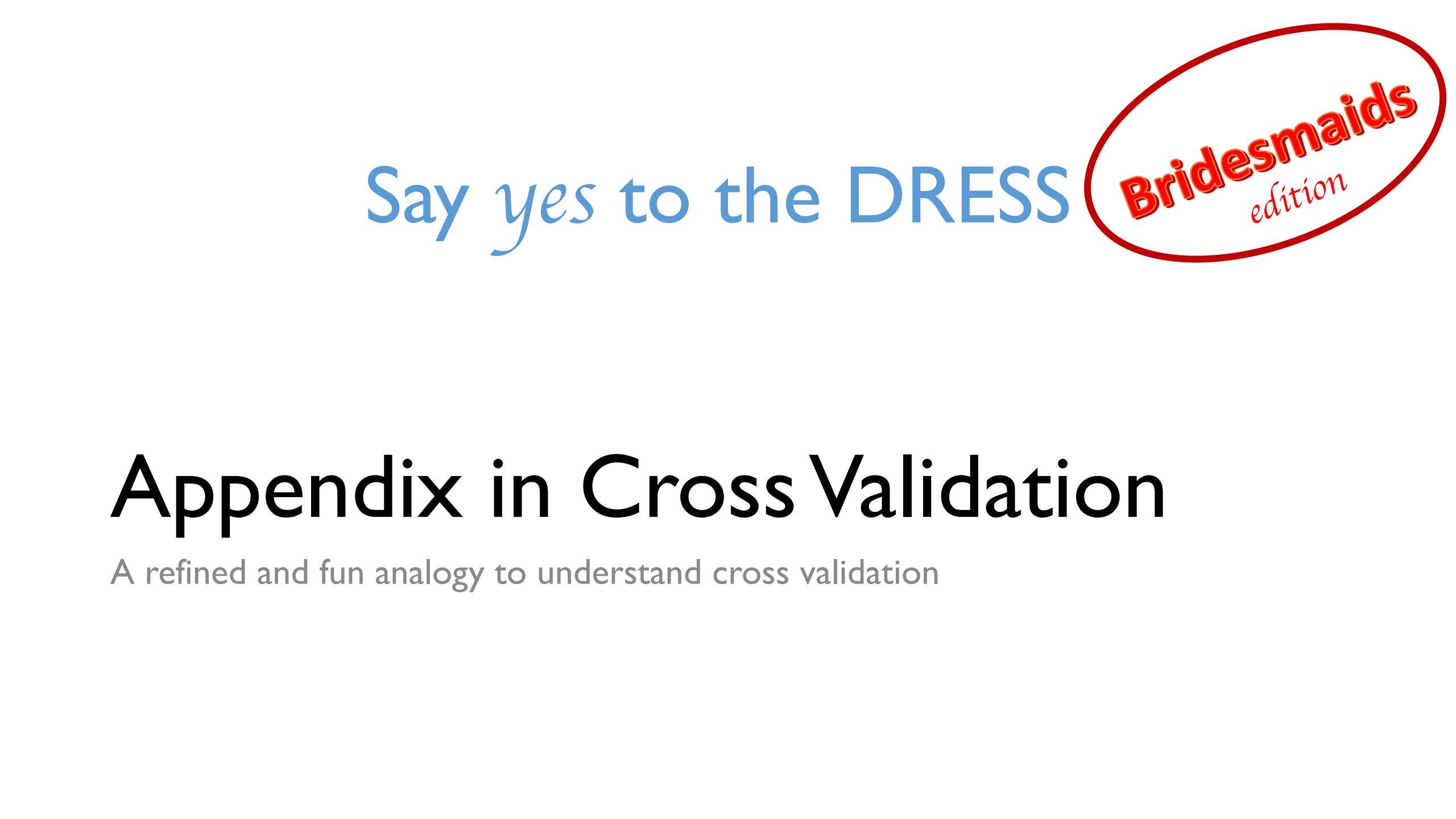

Appendix in Cross Validation

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