

# How to EasyDIF

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# 1. What's EasyDIF ?

EasyDIF is the software for analysis of Differential Item Functioning (DIF).

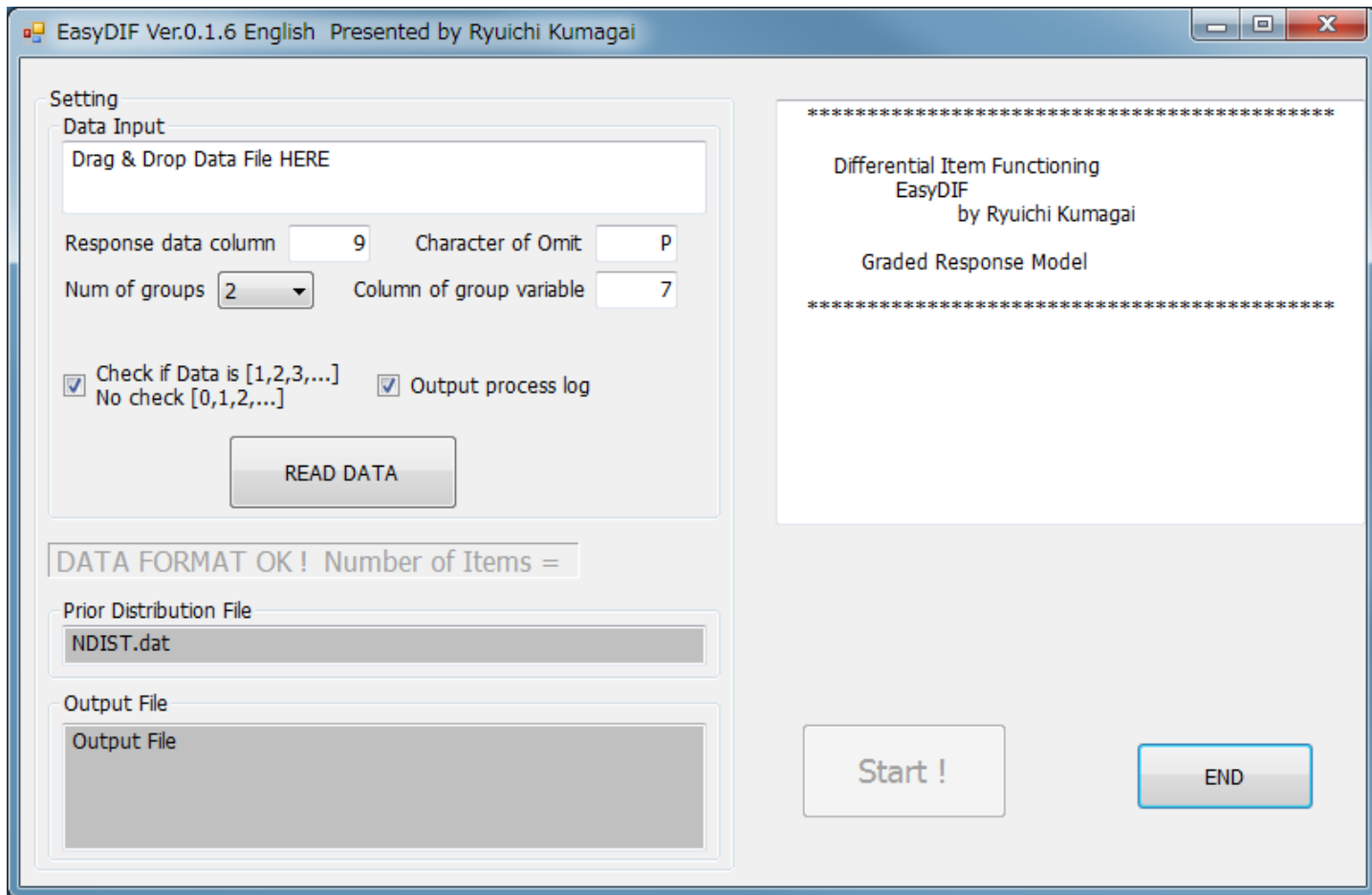
## Feature of EasyDIF

- “Index K” is used for measuring effectiveness of DIF.  
    “Index K” is original method by Ryuichi Kumagai.
- Comparison of two or more populations.
- Polytomous Data.
- GUI for “Easy” use.

## Reference

Kumagai, R. (2012) A new method for estimating differential item functioning (DIF) for multiple groups and polytomous items: Development of index K and the computer program "EasyDIF". Japanese Journal of Psychology, 83(1), 35-43. (in Japanese)

# 2.1 Run EasyDIF



# 2.2 Setting Data File



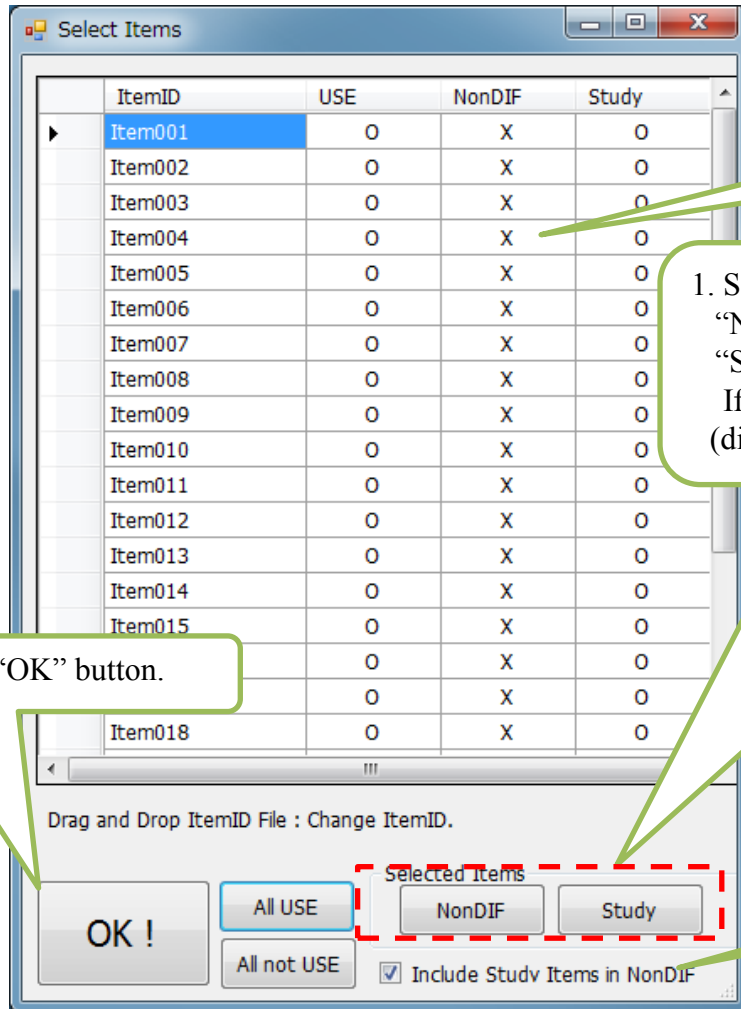
1. Drag & Drop "Data File".  
Data File is "txt format".  
See the attached "SampleData.dat".

2. Input Settings
- Column of Response located.  
(“9” in SampleData)
  - Character of Omit response.  
(initial value “P”)
  - Number of Groups.  
(“2” in “SampleData.dat”)
  - Column of Group Variable.  
(“7” in “SampleData.dat”)

The screenshot shows the EasyDIF V software interface. At the top, there is a text box labeled "Drag & Drop Data File HERE" with a red dashed border. Below this, there are several input fields: "Response data column" with a value of 9, "Character of Omit" with a value of P, "Num of groups" with a dropdown menu set to 2, and "Column of group variable" with a value of 7. There are also two checkboxes: "Check if Data is [1,2,3,...]" (checked) and "Output process log" (checked). A "READ DATA" button is located below these fields. At the bottom of the interface, there are two buttons: "Start !" and "END".

3. Click "Read Data" button.

# 2.3 Select Items



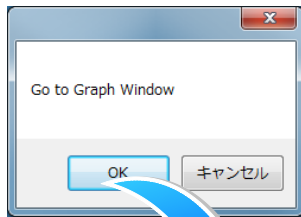
If you want to change ItemID, Drag & Drop "ItemID File" here. "ItemID File" is text file that recorded one ItemID per one line. (See and rewrite the attached "ItemID.dat".)

1. Select the items and decide "Non DIF" or "Study". "Non DIF" item is already known that which doesn't have DIF. "Study" item is that you examine whether "DIF" exist. If you wouldn't like to use, click the column of "USE" (displayed "X").

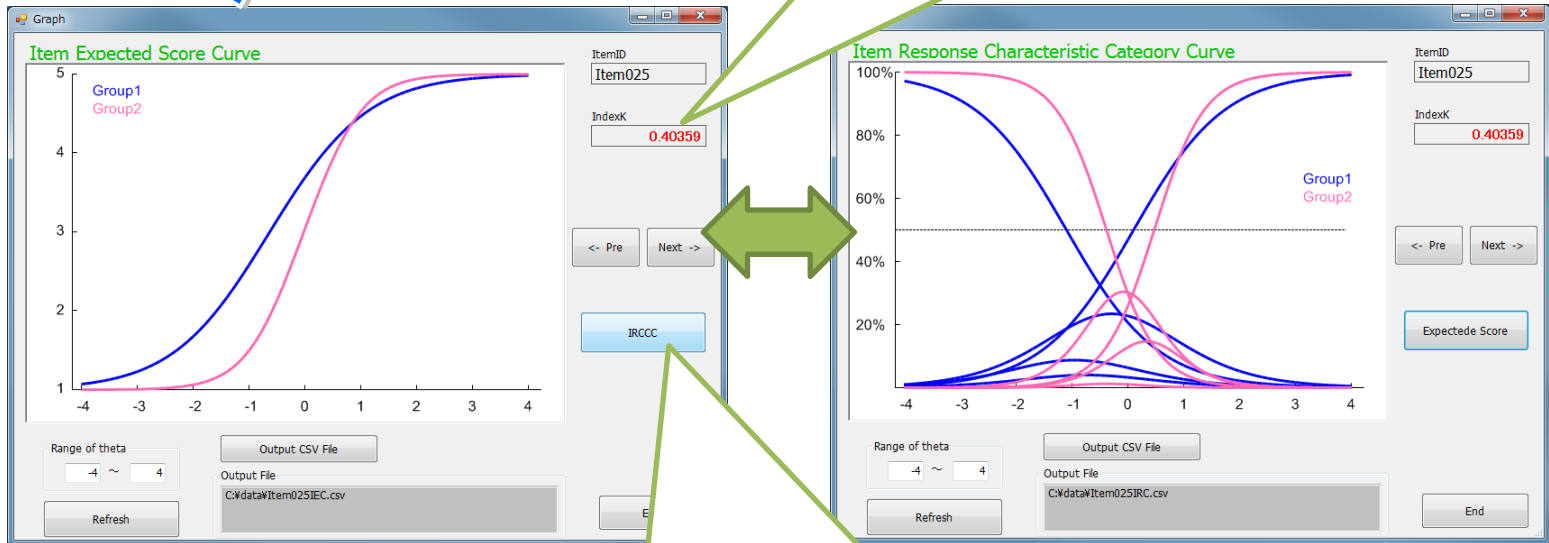
2. Click "OK" button.

If all items are "Study", they must be treated as "Non DIF". In case of this, check this option.

# 2.4 Graph window



If "Index K" was printed in red , that item has effects of DIF.

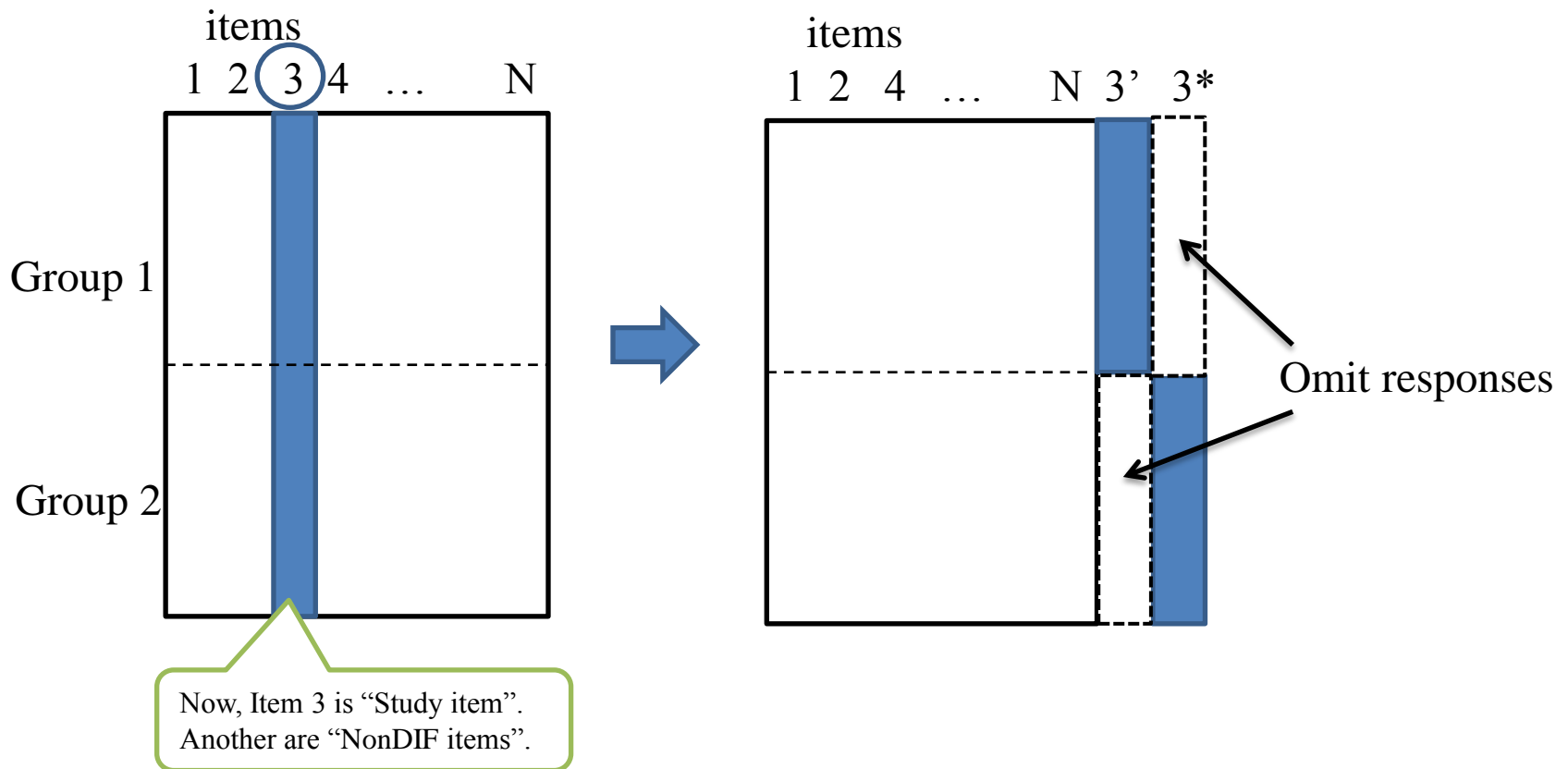


This button toggles the Expected Score Curve and IRCCC.

# 3. What's "Index K" ?

"Index K" is calculated using the following procedure.

Step 1. Splitting the data matrix.



# 3. What's “Index K” ?

Step 2. Calculating the item parameters.

We calculate the item parameters using data matrix in Step 1.

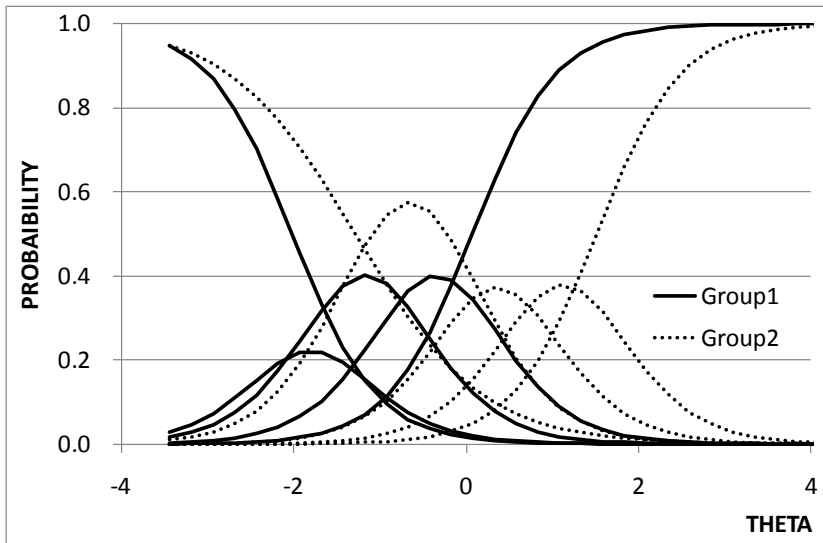
- EasyDIF uses Graded Response Model.
- Multi group model is adopted.

We obtain two sets of item parameters about study item (item 3' and 3\*), and two population distributions (group 1 and 2).



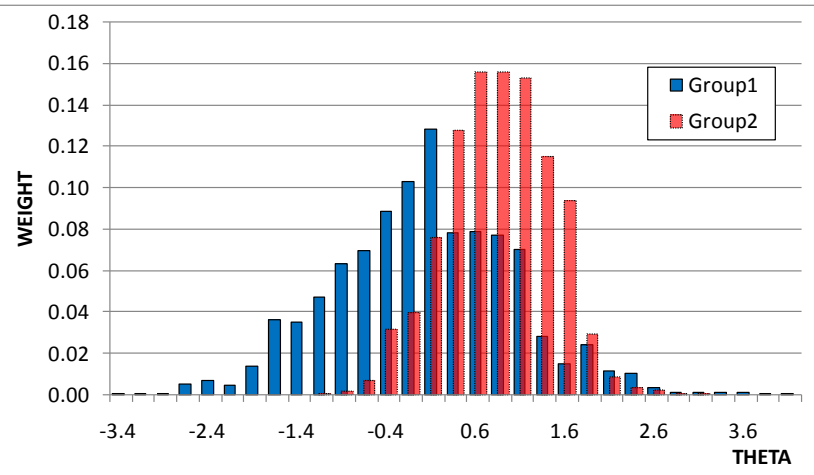
# 3. What's "Index K" ?

Step 2. Calculating the item parameters.



Item Response Category  
Characteristic Curve about  
study item.

Population Distributions.  
(Group1 and Group2)



# 3. What's “Index K” ?

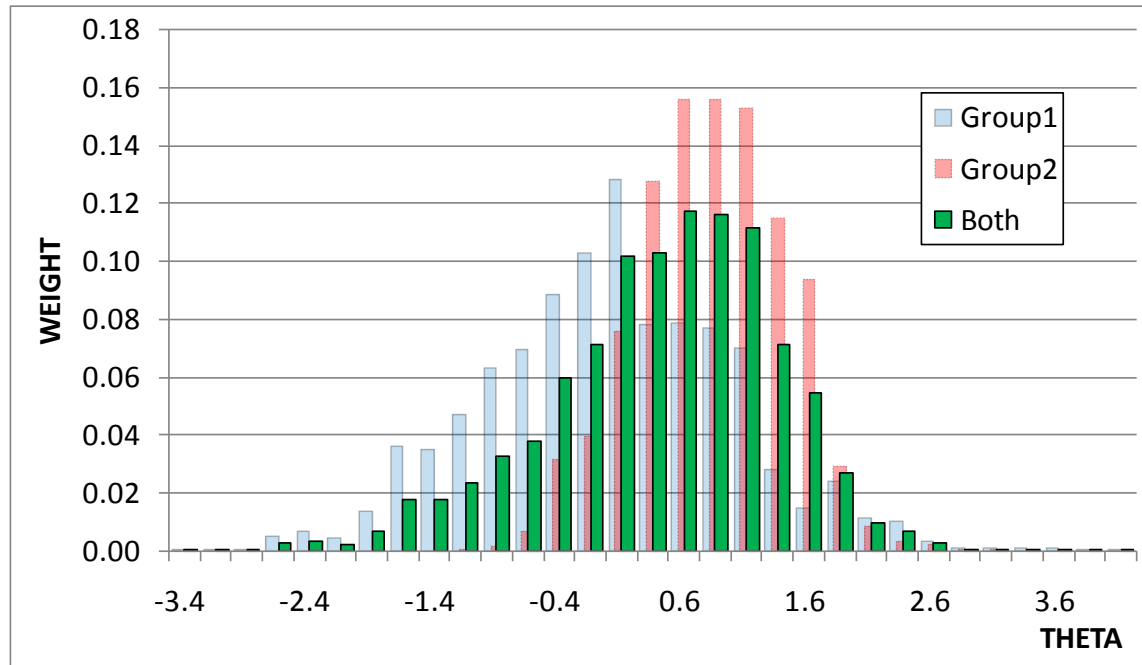
Step 3. Calculating mixing group distributions.

$$g_T = \frac{N_1}{N} g_1 + \frac{N_2}{N} g_2$$

$N \dots$  Number of all examinees

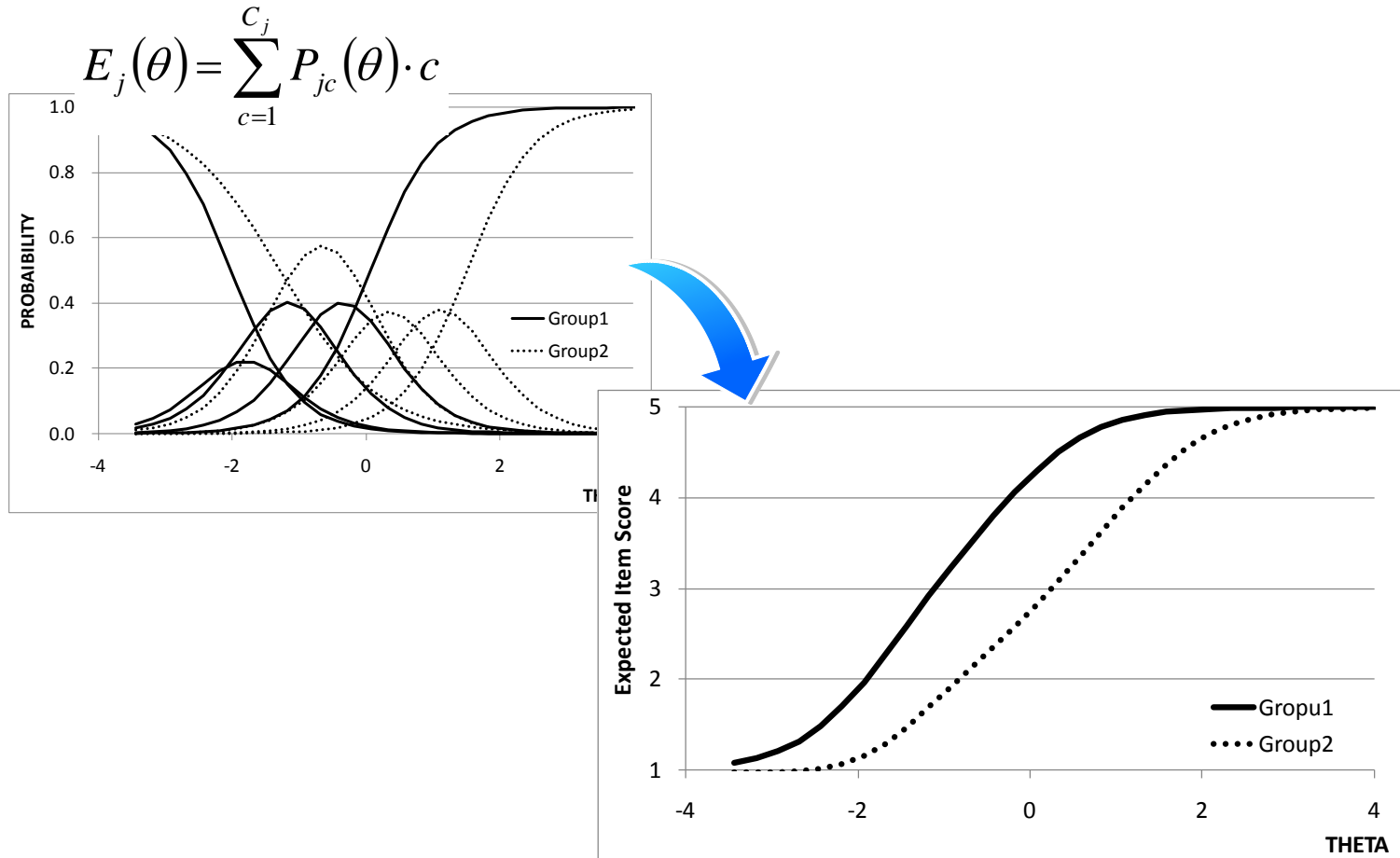
$N_1 \dots$  Number of examinees in group1

$N_2 \dots$  Number of examinees in group2



# 3. What's "Index K" ?

Step 4. Calculating item expected score curve.



# 3. What's “Index K” ?

Step 5. Calculating index K.

$$K = \int_{-\infty}^{\infty} |P_1(\theta) - P_2(\theta)| g_T(\theta) d\theta$$
$$\approx \sum_{q=1}^Q |P_1(\theta_q) - P_2(\theta_q)| g_T(\theta_q)$$

Index K is a combination of Thissen's method (Thissen, Steinberg, & Wainer, 1993) and SIBTEST (Shealy & Stout, 1993).

Shealy, R., & Stout, W. (1993). A model-based standardization approach that separates true bias/DIF from group ability differences and detects test bias/DTF as well as item bias/DIF. *Psychometrika*, **58**, 159-194.

Thissen, D., Steinberg, L., & Wainer, H. (1993). Detection of differential item functioning using the parameters of item response models. In P. W. Holland & H. Wainer (Ed.), *Differential item functioning*. Hillsdale, NJ: Lawrence Erlbaum. pp. 67-113.

# 4. Interpretation of “Index K”

If index K is larger than "**(Number of categories - 1)\*0.1**", we assume that DIF is large. (e.g.: in dichotomous item  $(2-1)*0.1=0.1$ , and 5 points scale items  $(5-1)*0.1=0.4$ )

In EasyDIF's output file, if index K is larger than "**(Number of category - 1)\*0.1**", it displays "**###**".

ItemID,	IndexK,	>	(#Category-1)*0.1
Item001,	0.04747		
Item002,	0.06345		
Item024,	0.78765,	###	
Item025,	0.40359,	###	

# 4. Interpretation of “Index K”

Kumagai(2012) reported that "(Number of category - 1)\*0.1" is equivalent to " $\Delta MH > 1.5$ ".

"  $\Delta MH > 1.5$ " means "large" DIF in ETS research(Roussos & Stout, 1996).

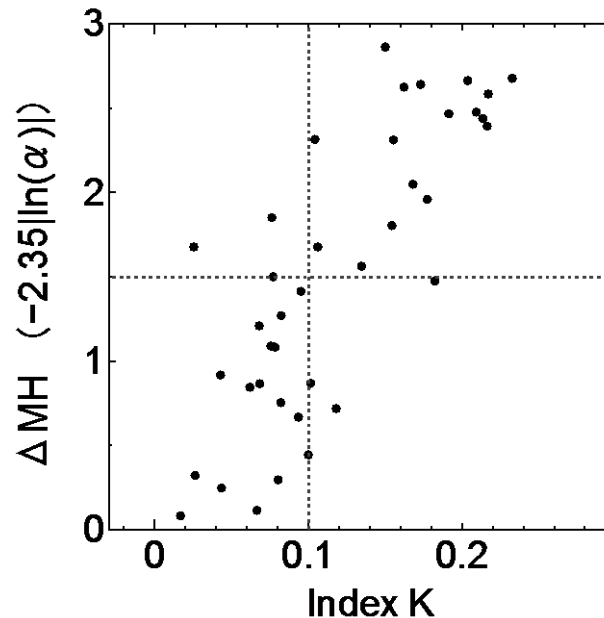


Figure : Plots Index K and  $\Delta MH$  in dichotomous simulation data.  
(Kumagai, 2012)

# 4. Interpretation of “Index K”

Index K means that average of correct probability (or expected category) differences among groups.

It is same definition in Beta estimates in SIBTEST(Shealy & Stout, 1993).

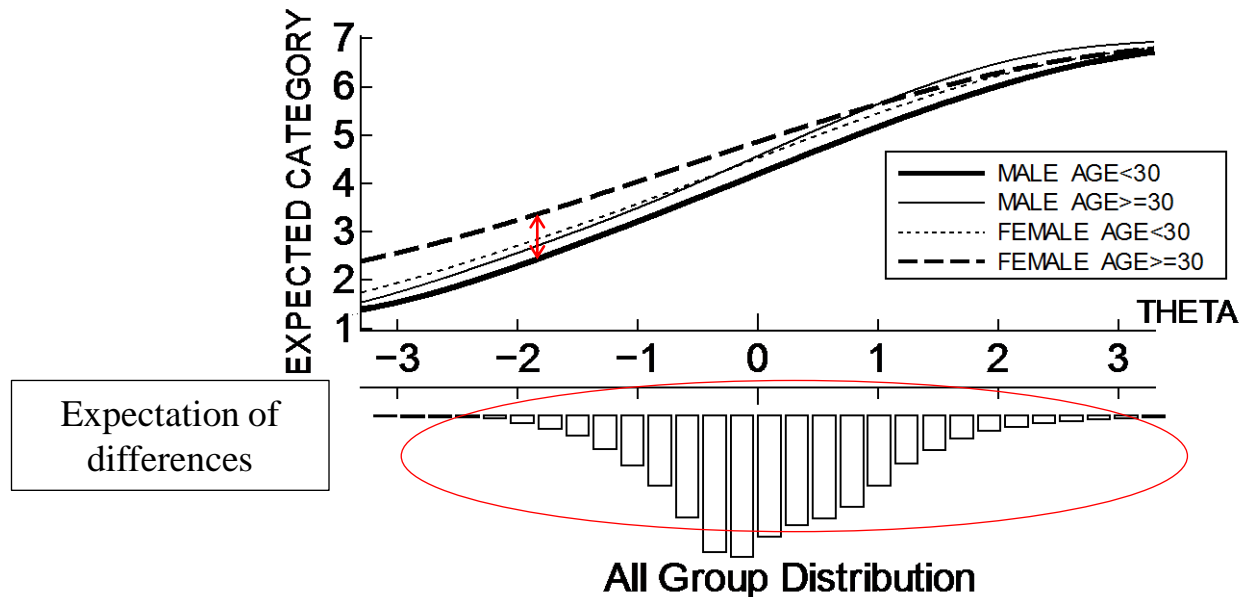


Figure : Item Expected category characteristic curve in Big-Five scale data.  
(Kumagai, 2012)

Thank you !

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