psyc3010 lecture 1

introduction to course and housekeeping
introduction to factorial designs

next week: factorial anova

lecturer

Winnifred Louis

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- **contact hours:**
  - **Before class at the lecture**
  - **After class at the lecture**
  - **Wednesdays 1-3pm**
  - **You are welcome to drop by and ask for an appointment!**

Tutors

- Elizabeth Puhakka, Lead Tutor
- Beth O’Brien
- Stephen Barrett
- Contact info TBA

A note about the value of attendance

- I post detailed slides before every lecture
- I also keep track of attendance. There is no penalty for skipping, but keep this in mind ->
- There is a document posted on the course BlackBoard web site with more detailed info and stats from ’05-’06.
- The data show that tutes also valuable, esp. for higher assignment marks

Absent	Always /Often	Some-times	Rarely/ Never
Drop-outs (27%)	**50%**	20%	0%
Fails among finishers (8%)	**29%**	4%	3%
1sts (9%)	0%	13%	**23%**

Why is attendance so important?

Strange because detailed class notes available every week online

Even worse 2006 (44% chronic skippers failed) & 2005 (39% chronic skippers failed); controlling for second year grades (and, in '06, anxiety), attendance delivered a 15-20% boost in final 3rd year grades.

- explanation #1: **3rd factor** hurts attendance & marks
  - ✓ sickness
  - ✓ family and/or work obligations
- explanation #2: **added value** to regular attendance
  - ✓ immediate clarification of confusing material
  - ✓ rehearsal of knowledge over multiple classes
  - ✓ rate of knowledge absorption spread over term (rather than over the 2 weeks before the exam)

Managing anxiety & motivation

- Do the work regularly
- Find small attainable goals along the way
- Be methodical: organise
- Do not AVOID !
- Take heart – 2006 data suggest anxiety early in the course is unrelated to outcomes (controlling for 2nd year grades & attendance, you get just as good marks no matter how much anxious you have)

course structure

- **one 2 hour lecture per week**
  - Wednesday 4-6pm in this room (Building 50, Rm T103)
  - Covering theory, examples and applications
  - Slides available from the web before each lecture
- **one 2 hour tutorial per week**
  - ***Nominations to be made during the break!***
  - Final times and locations on 3rd year noticeboard this week
  - Tute allocations will also be posted on Blackboard, if all goes well
  - Mostly covering examples to work through and interpret
  - Some tutes will consist of computer-based analyses using SPSS: Not to be missed!
  - Lecture and tutorial materials do not overlap perfectly
- Ongoing Blackboard **web site**
  - Need to monitor web site regularly for announcements and files
  - Should also check out and ideally post to web forum
    - Warning: **NEVER post answers to assignment**
    - **NEVER post or answer any question with specific numbers or quotations from the assignment** in it on the forum
    - will end up penalised for plagiarism or collusion even if meant to be helpful (argh!)

materials and resources

- **textbook**
  - Howell, D. C. (2007). *Statistical Methods for Psychology.* (6th Ed). Pacific Grove, CA: Duxbury Thomson Learning.
  - Field, A. (2006). *Discovering statistics using SPSS.* (2nd Ed.). London: SAGE

  - Page refs will be provided for both this year
  - Next year we will transition to Field entirely
  - Field's better for struggling students, has SPSS. But uses slightly different equations sometimes.
  - Howell's a more gifted mathematician but can be difficult reading. Lectures this year use Howell equations mostly.
- **tutorial workbooks**
  - 1 hardcopy of each of 3 books available in the first tute. Otherwise posted online for you to reprint yourself.
- **lecture notes**
  - on web as noted – useful to bring to each lecture

materials and resources

- **use online resources which we will make available during the semester:**
  - ☞ review of statistical symbols and terminology
  - ☞ review of key material from 2nd year statistics
  - ☞ additional exercises (building on practicals)
  - ☞ tips for completing assignments
  - ☞ practice exam questions

Psyc3010 – factorial designs, multivariable analyses - the grass/roots

Factorial ANOVA between/within & mixed	**Multiple Regression**	**Log-linear analysis**
ANOVA & **t-tests** between/within	**Bivariate** (simple) **correlation**	**Chi-square**

Assumed Knowledge!!!

assessment

- **two written assignments**
  - approximately 1500 words, each comprising 20% of the final grade
  - due dates are :
    - assignment 1 → 4pm Monday September 8th
    - assignment 2 → 4pm Monday October 20th
- **final exam**
  - comprising 60% -- combination of multiple-choice and short-answer questions
- you must complete each assessment item in order to pass the course

extensions

- **extensions for assignments must be sought through the appropriate channels BEFORE the assignment due date**
  - application forms are available from the Undergraduate Course Centre, level 2 in the Psychology Building (where you normally deposit your assignments)
  - for medical conditions, medical certificates must be provided
  - penalties apply for late submissions without approved extensions (one mark per day, including weekends or public holidays)

appeals

- **what if you are not satisfied with the mark your tutor has given you, or you believe there is an error in marking?**
  - **Firstly**, wait 1 week after your assignment has been returned (your tutor most likely will have late assignments to mark, and the extra week will give you time to consider the matter fully)
  - **Secondly**, approach your tutor and ask for further feedback. Explain why you disagree with the mark given.
  - **Finally**, if an agreement is not reached, you are entitled to have the assignment remarked. To do this:
    - **Use the School of Psychology request for remark form**
    - ***Be aware that the decision of the second marker is final and your amended mark may be lower***

tute nominations

5 Time slot options (6 tutes will be offered):

- Wednesday 6-8pm (x2), 8-10pm
- Thursday 12-2pm, 2-4pm
- Friday 10am-12pm

- Sign-up will be via My SI-NET as of Wednesday July 23rd (today!)

- part time students with full time work, care giving responsibilities or similar may need the 6-8 tutes!

  If you're a full time student, please do NOT sign up for the 6-8pm tutes on Wednesdays until AFTER 8am July 24th (i.e., allowing the part-timers to get in ahead of you). 8-10pm is ok – less popular.

- Questions about tute sign-up? See me during class or e-mail Lead Tutor (Liz – e.puhakka@psy.uq.edu.au) afterwards

simple (one-way) designs

- **experiment 1 –** "what effect does the kind of stats examples I use have on your stats recall (in the exam)?"
  - *N* = 18 in 2 conditions
  - I give *silly* examples OR *serious* examples, then test your recall (pop quiz)

  - IV → example type (2 levels)
  - DV → quiz performance
  - analysed with an independent samples t-test or one-way anova

simple (one-way) designs

- **experiment 2 –** "what is the effect of my lecture preparation on your stats recall (in the exam)?"
  - *N* = 18 in 3 conditions
  - I give lecture after 1 full day of preparation, 1 hour of preparation, OR no preparation, then test your recall (in exam)

  - IV → lecturer preparation (3 levels)
  - DV → exam performance
  - analysed with one-way anova
  - Then follow-up tests to find differences among the means

factorial designs

- **we can combine these two one-way experiments using a *factorial* design**
  - a factorial experiment has at least two **factors** (IVs), each with at least two levels
  - then the two IVs can be examined simultaneously – example type and lecturer preparation can be ***crossed***

data table for one-way design

participants are randomly assigned to one level of Factor 1

Lecturer Preparation			
None	Some	Heaps	
5	7	16	
7	8	8	
3	6	12	
10	6	8	
6	7	7	
8	11	9	
6.5	**7.5**	**10**	**8**

a data table for a one-way design

We have “a” or “j” groups (Factor A has a levels or Factor X has j levels)

We compare group means to each other / to the grand mean

Lecturer Preparation			
None	Some	heaps	
5	7	16	
7	8	8	
3	6	12	
10	6	8	
6	7	7	
8	11	9	
6.5	**7.5**	**10**	**8**

One-way ANOVA

- One IV
- Group means compared to each other & to the grand mean
- If they are different, there is an effect of the IV

data table for two-way design

	Lecturer Preparation			
e.g. Type	None	Some	Heaps	
Silly	5 7 3 ***5***	7 8 6 ***7***	16 8 12 ***12***	**8**
Serious	10 6 8 ***8***	6 7 11 ***8***	8 7 9 ***8***	**8**
	6.5	**7.5**	**10**	**8**

participants are randomly assigned to
one level of Factor 1 ***and*** one level of Factor 2

factorial vs one-way designs – research questions

- **a one-way design asks one question**
  - are the mean dependent variable scores of the populations for each level of the factor different from the grand mean (from each other)?

- **a factorial design asks more questions**
- **In a two-way factorial design:**
  - are the means of the populations corresponding to the levels of the first factor different - *is there a **main effect** of factor 1?*
  - are the means of the populations corresponding to the second factor different - *is there a **main effect** of factor 2?*
  - do the two factors act in combination to affect scores on the dependent variable - *is there a factor 1 X factor 2 **interaction**?*

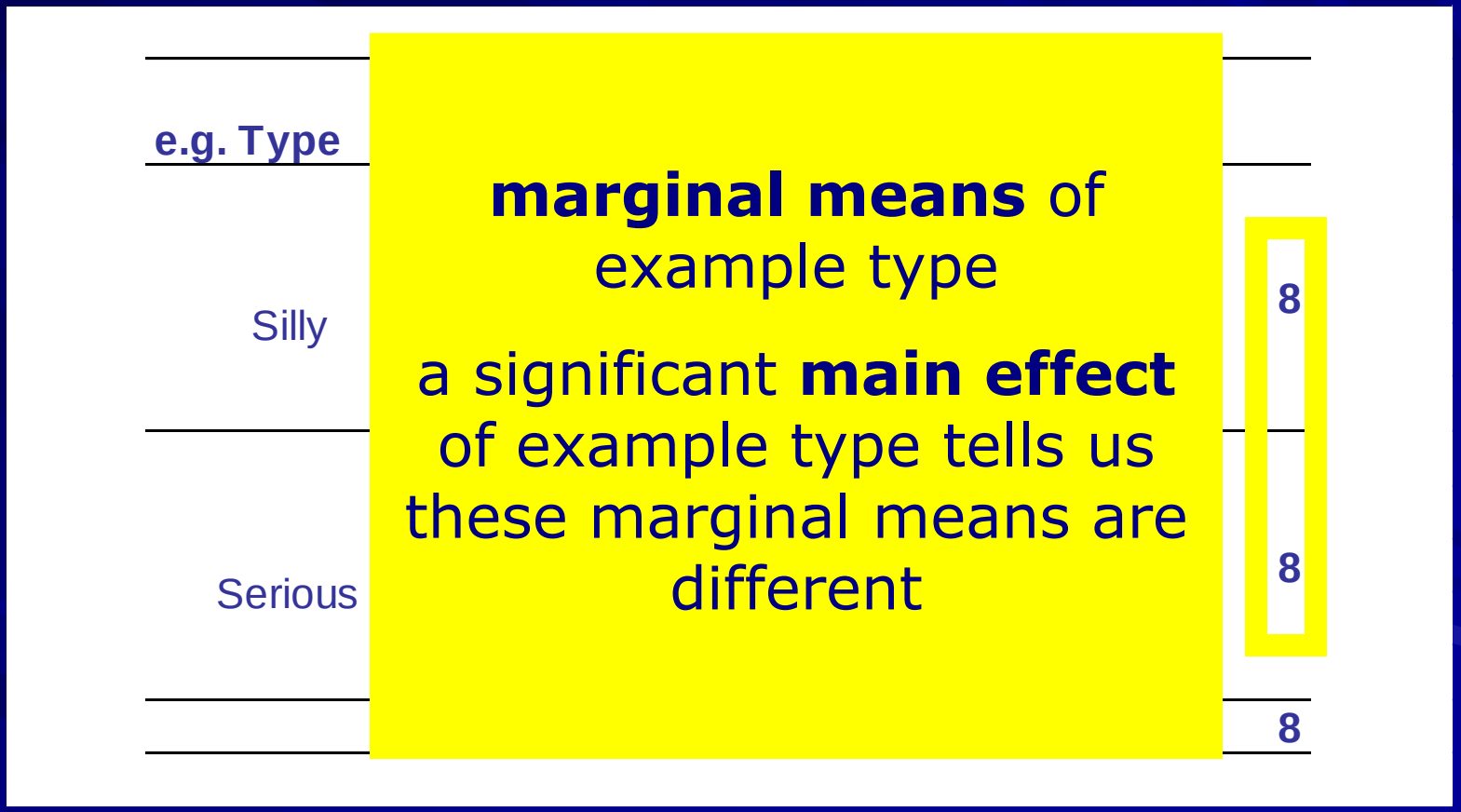
a data table and some notational standards

	Lecturer Preparation			
e.g. Type	None	Some	All	
	5	7	16	
	8	***8***	***8***	
	6.5	**7.5**	**10**	**8**

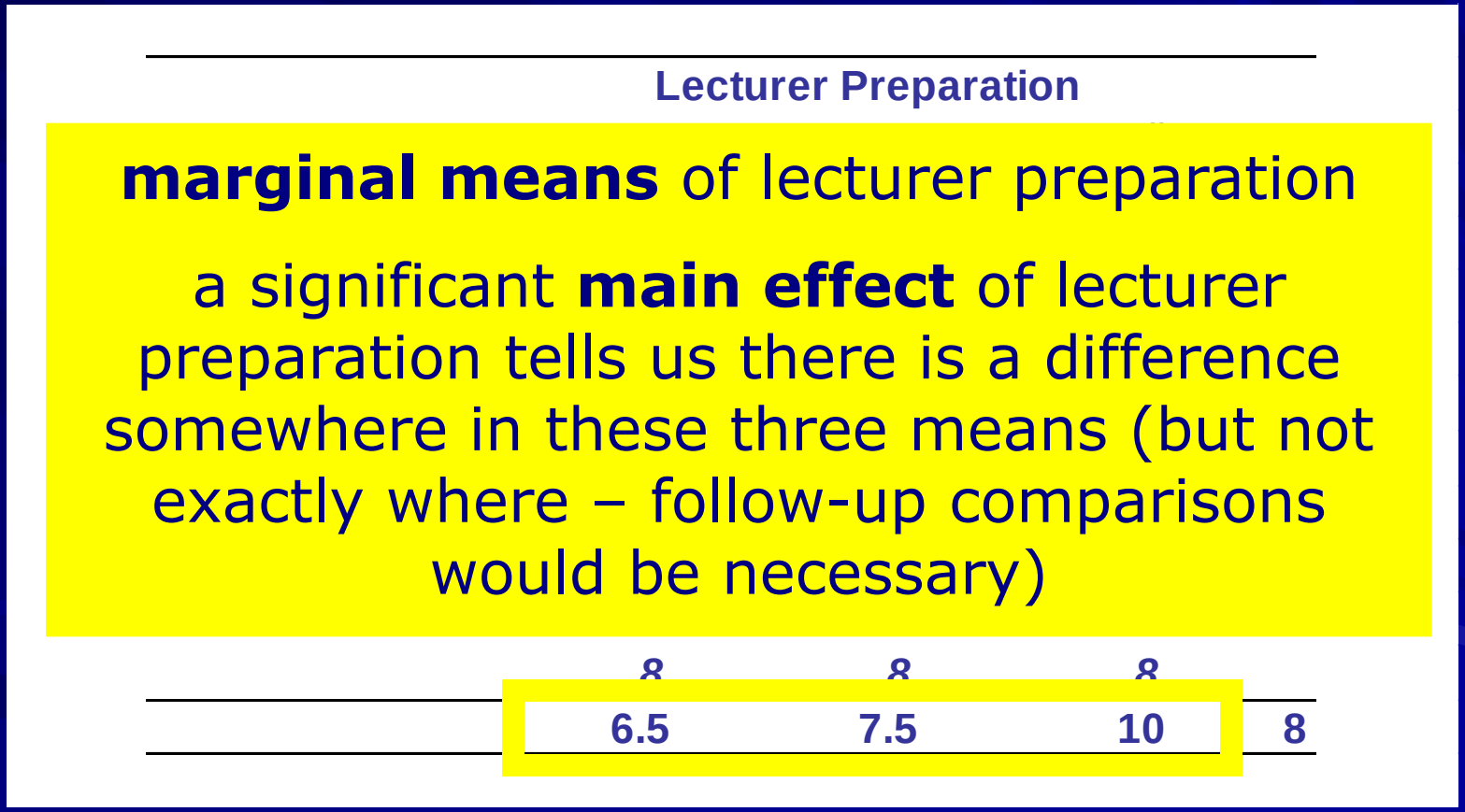
the grand mean

the mean of all observations – not as important for inferential purposes but forms part of the structural model of ANOVA

a data table and some notational standards



a data table and some notational standards



marginal means of lecturer preparation

a significant **main effect** of lecturer preparation tells us there is a difference somewhere in these three means (but not exactly where – follow-up comparisons would be necessary)

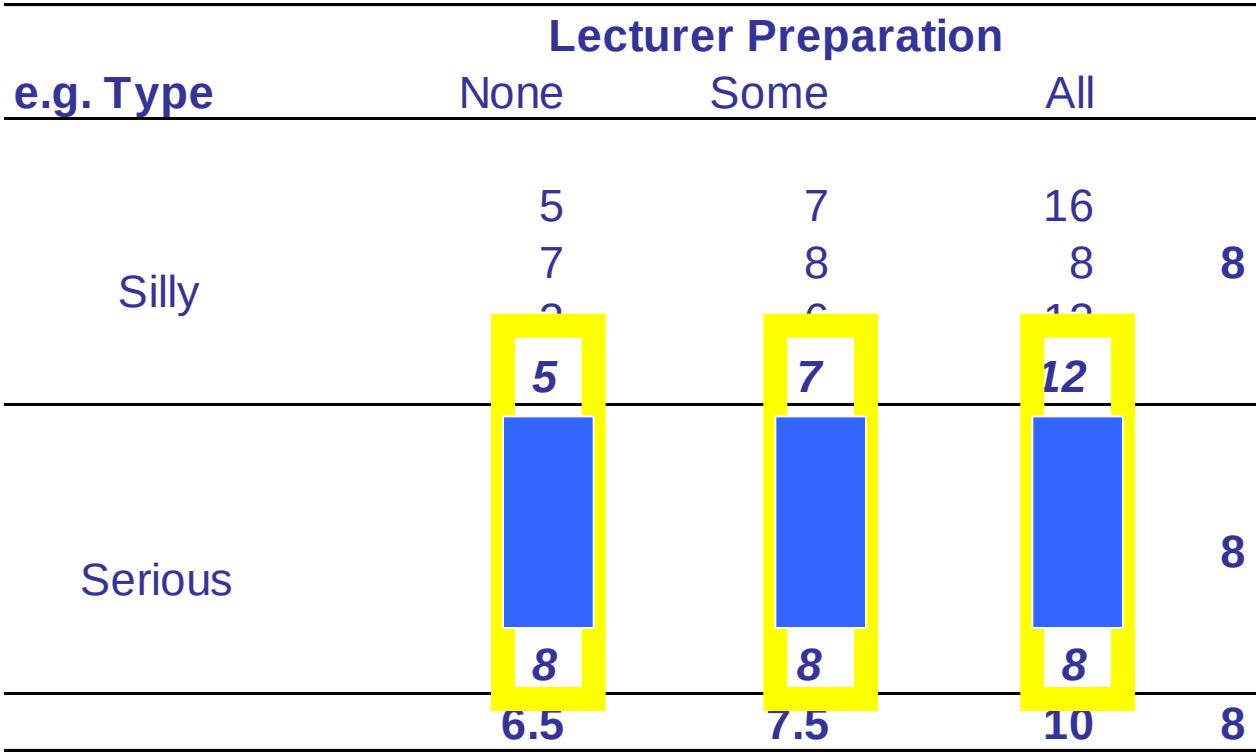
cell means

the effect of one factor at one level of the other factor is called a **simple effect**

	Lecturer Preparation			
e.g. Type	None	Some	All	
Silly	5	7	16	
	7	8	8	**8**
	3	6	12	
	5	***7***	***12***	
Serious	10	6	8	
	6	7	7	**8**
	8	11	9	
	8	***8***	***8***	
	6.5	**7.5**	**10**	**8**

cell means

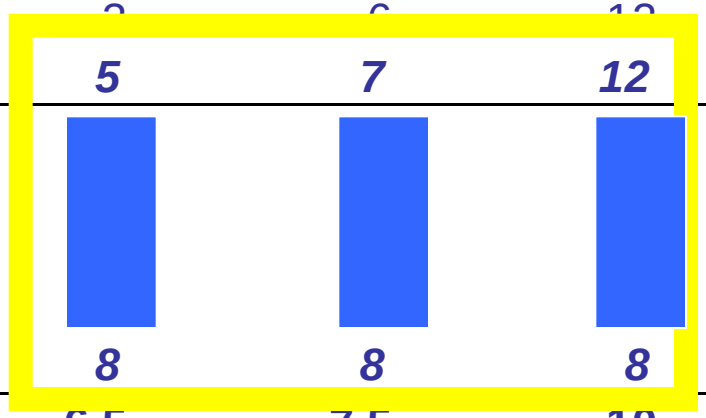
the effect of one factor at one level of the other factor is called a **simple effect**



cell means

when the effect of one factor is conditional upon the levels of the other factor we have an **interaction** (the simple effects are used to interpret an interaction)

	Lecturer Preparation			
e.g. Type	None	Some	All	
Silly	5 7 ...	7 8 ...	16 8 ...	**8**
	5	***7***	***12***	
Serious	***8***	***8***	***8***	**8**
	6.5	**7.5**	**10**	**8**



advantages of factorial designs

- **more economical in terms of participants**
  - a two-way factorial design requires fewer participants than two one-way designs for the same level of power, because we ***average*** over the the other factor
- **allows us to examine the interaction of independent variables**
  - does the effect of example type on recall ***depend*** on lecturer preparation?
  - the ***generalisability*** of results can be assessed – is the difference described by a main effect the same across levels of the other factor?
  - One independent variable interacts with another independent variable when the effects of one variable are different depending on which level of the other variable you are considering
  - One independent variable interacts with another variable when it changes (“moderates” or “qualifies”) the impact of a second independent variable on the dependent variable

notation in factorial designs

- **by the number of factors involved (general)**
  - two-way between-subjects factorial design
- **by the number of levels of each factor involved (specific)**
  - 2x3 between-subjects factorial design
- Factor A = example type (*a=2 levels)*
- Factor B = lecturer preparation (*b=3 levels)*
  - therefore, design is 2 x 3 between-subjects
  - in 2 x 3 design there are 6 cells = 6 treatments with *n* observations (*n*)

a data table and some notational standards

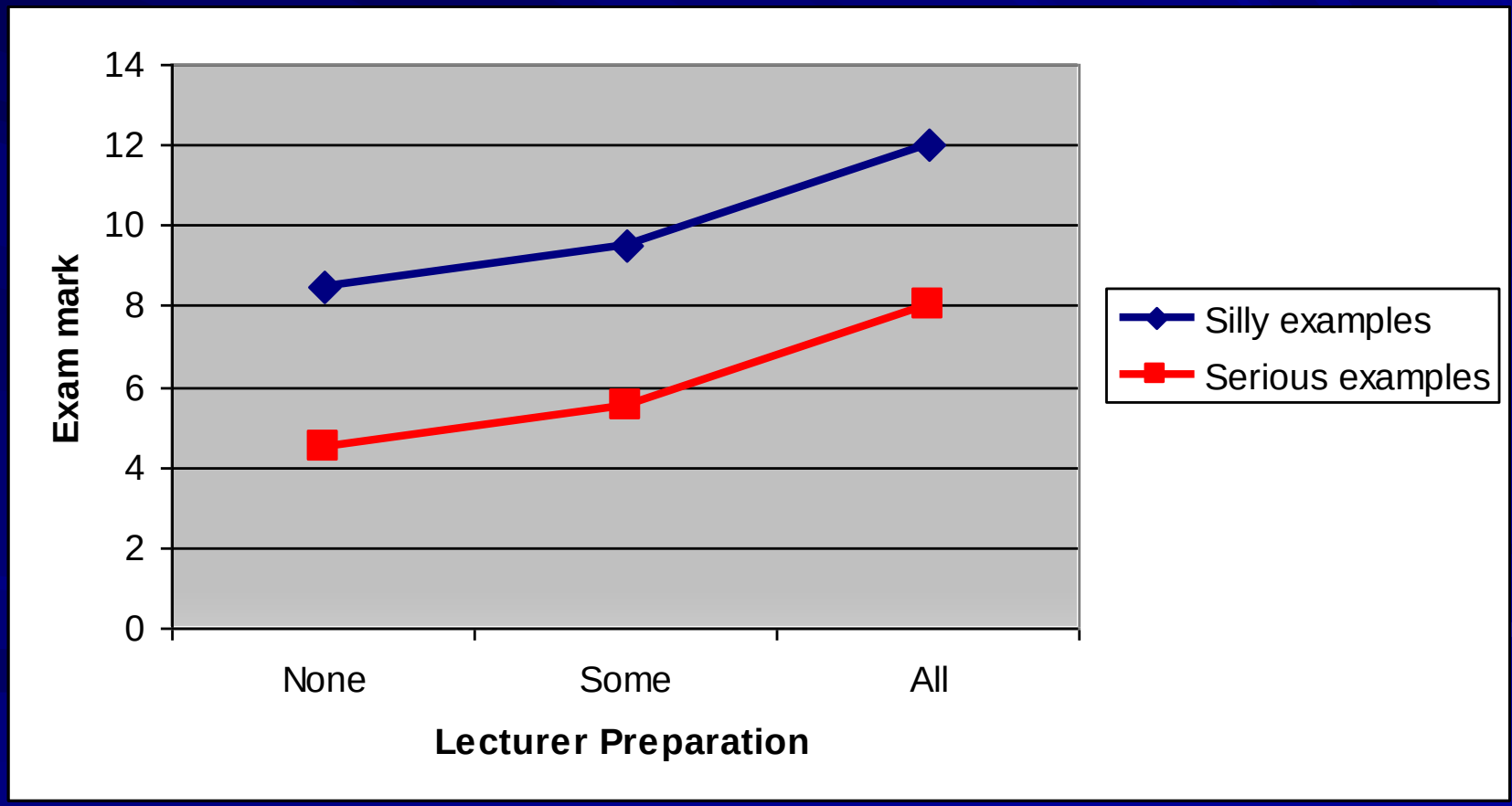
	Factor B **Lecturer Preparation**			
e.g. Type	None	Some	All	
Factor A Silly	5 7 3 ***5***	7 8 6 ***7***	16 8 12 ***12***	**8**
Serious	10 6 8 ***8***	6 7 11 ***8***	8 7 9 ***8***	**8**
	6.5	**7.5**	**10**	**8**

plotting main effects & interactions

- **y-axis is for the dependent variable**
- **x-axis is for the factor with the most levels or for the factor which is most theoretically important**
- **other factor (with fewer levels or which is less interesting) represented by separate lines on the graph**
- **all *cell means* in the design must be represented on the graph**

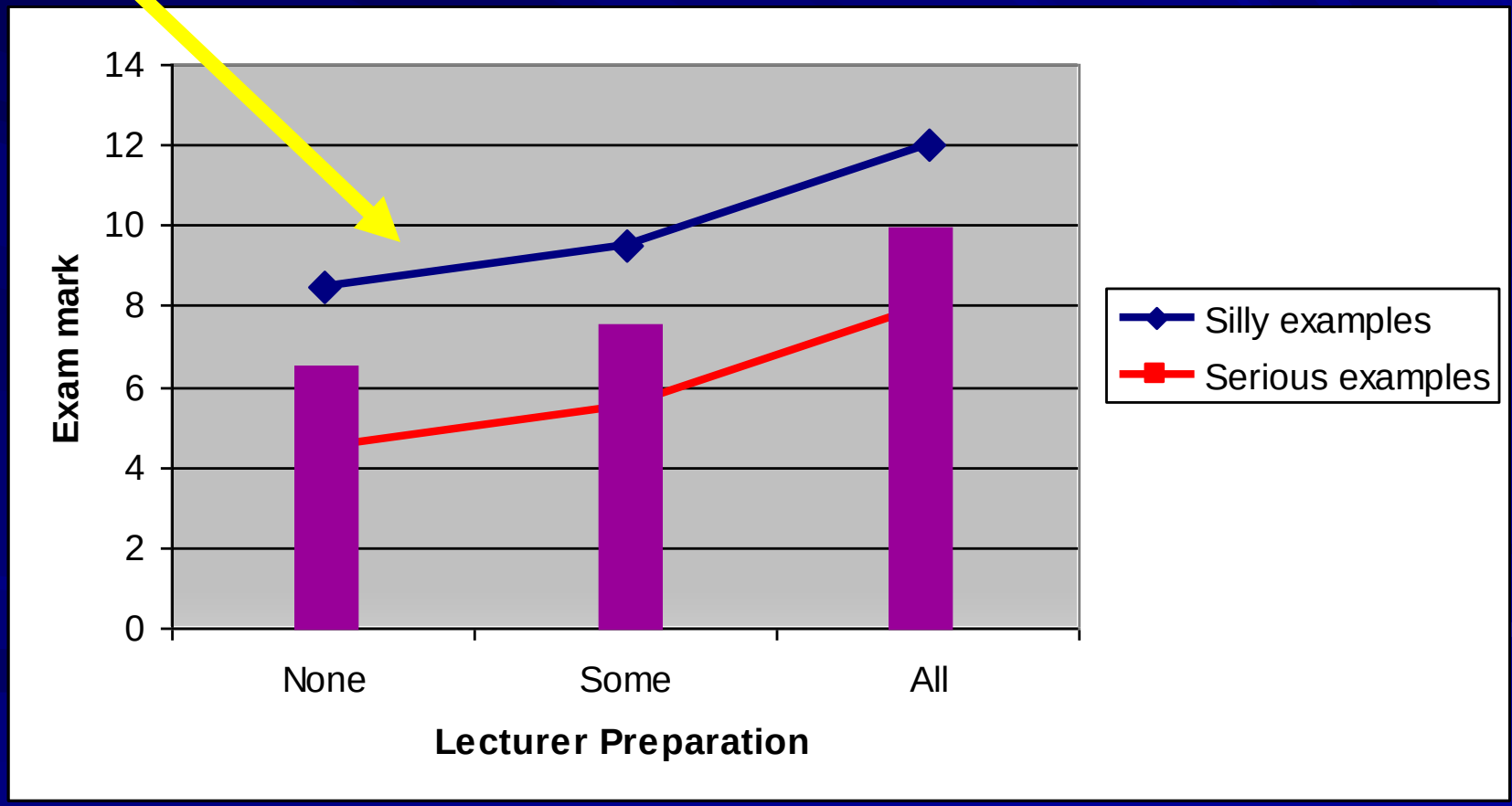
- Parallel lines indicate that there is no interaction
- non parallel lines indicate an ***interaction***
  - disordinal interaction (lines cross – signs reverse)
  - ordinal interaction (lines do not cross – signs do not reverse)
  - range of measurement affects whether an interaction is ord or disord
- evidence for ***main effects*** is a bit harder
  - differences in the average height of the levels of the factor

possible outcome – 2 main effects and no interaction



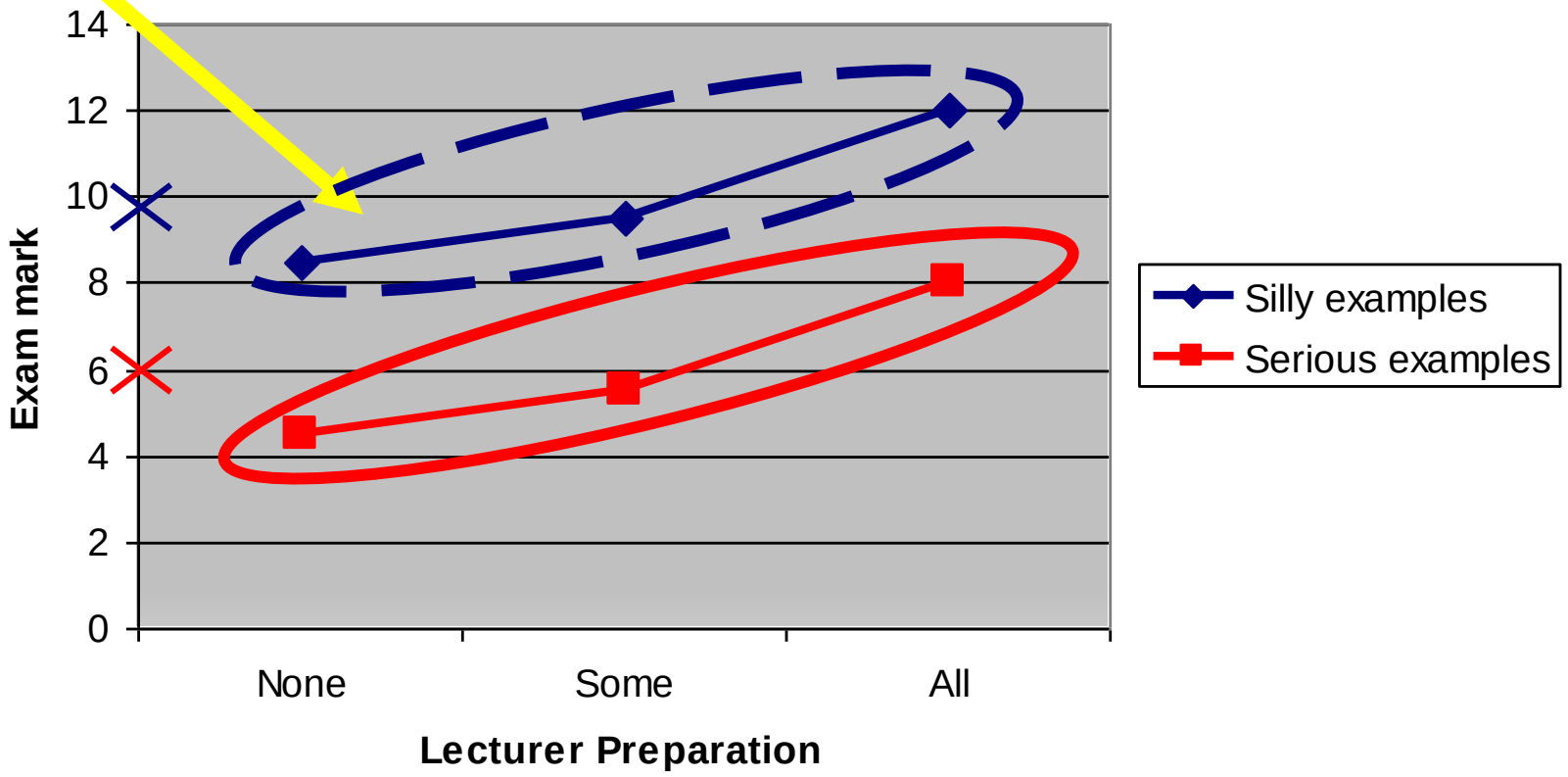
Main effect of lecturer preparation

When we average across example type:
Exam marks vary over lecturer preparation



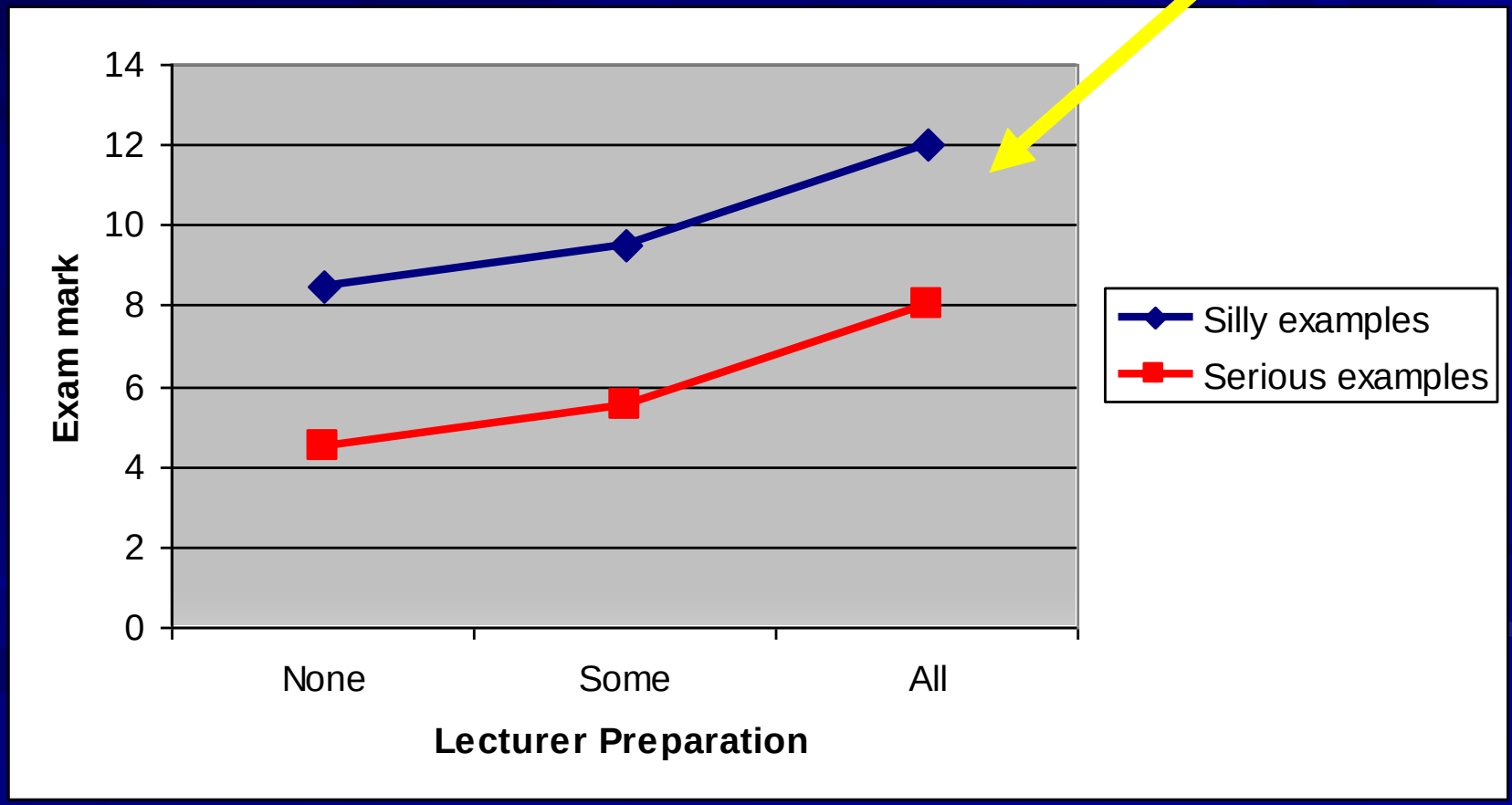
Main effect of example type

When we average across lecturer preparation, exam mark after silly examples is higher than exam mark after serious examples

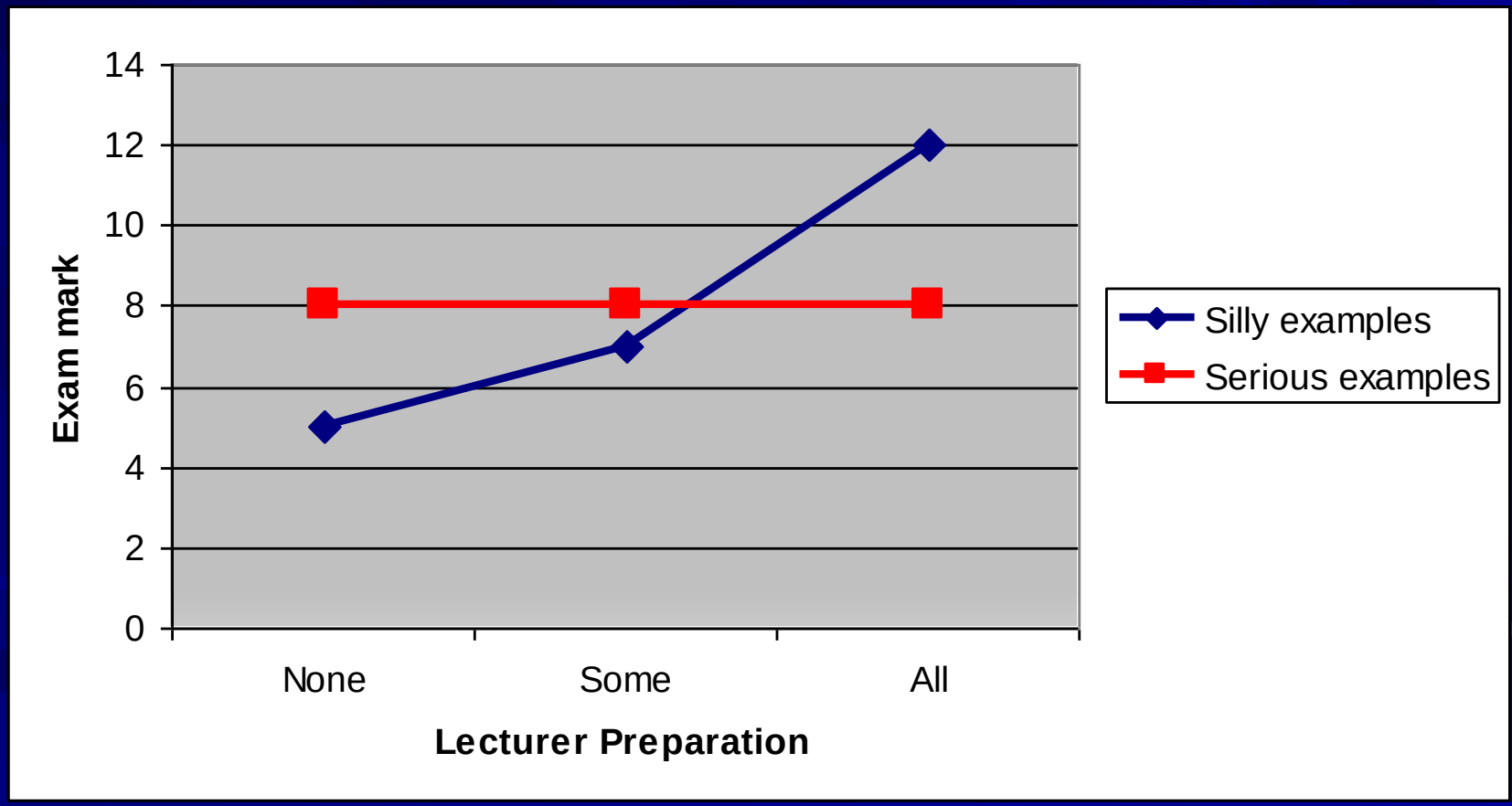


No Interaction

Lines are parallel: effect of lecturer preparation does not depend upon example type

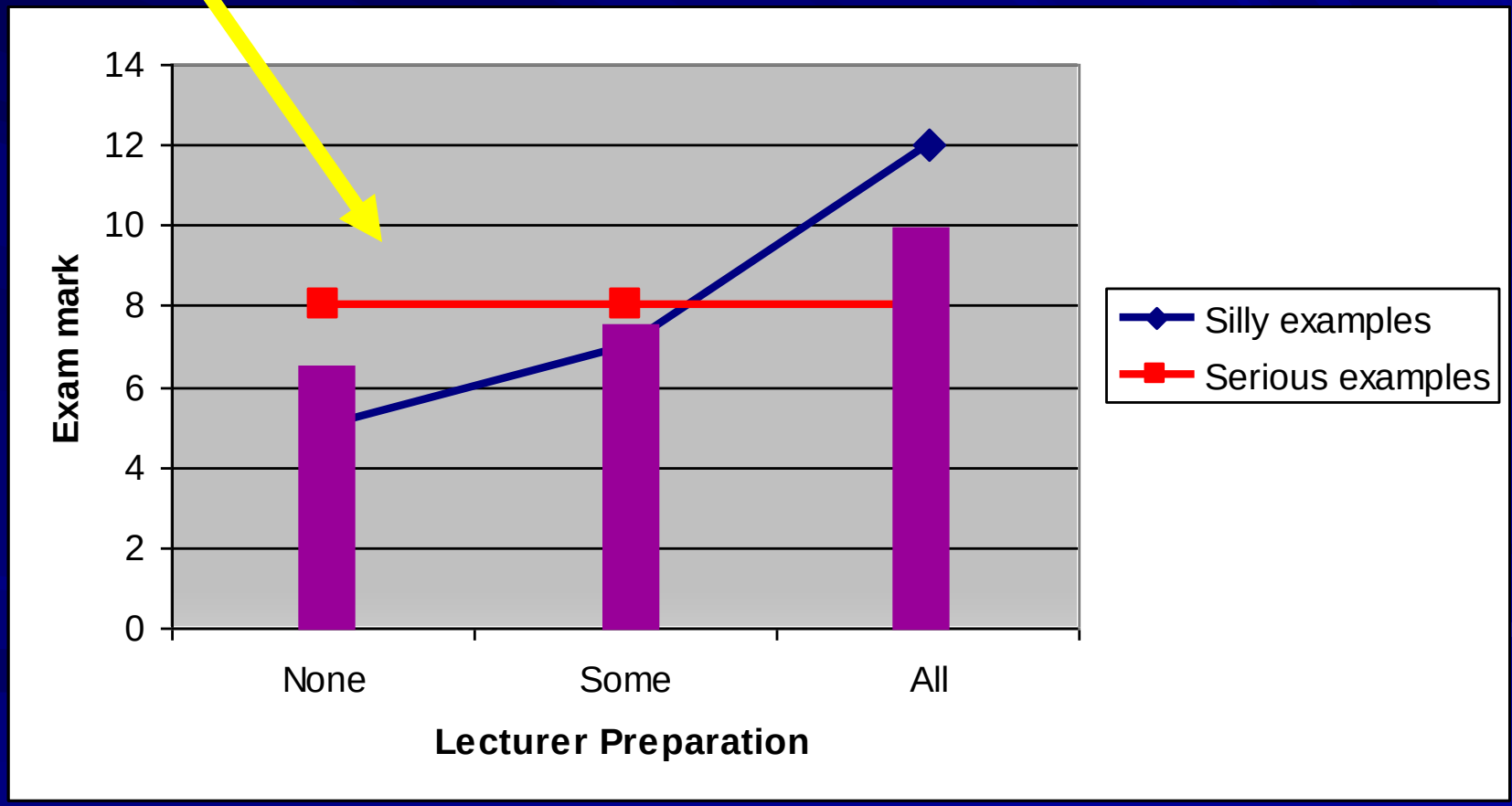


data from previous table – one main effect and a (disordinal) interaction



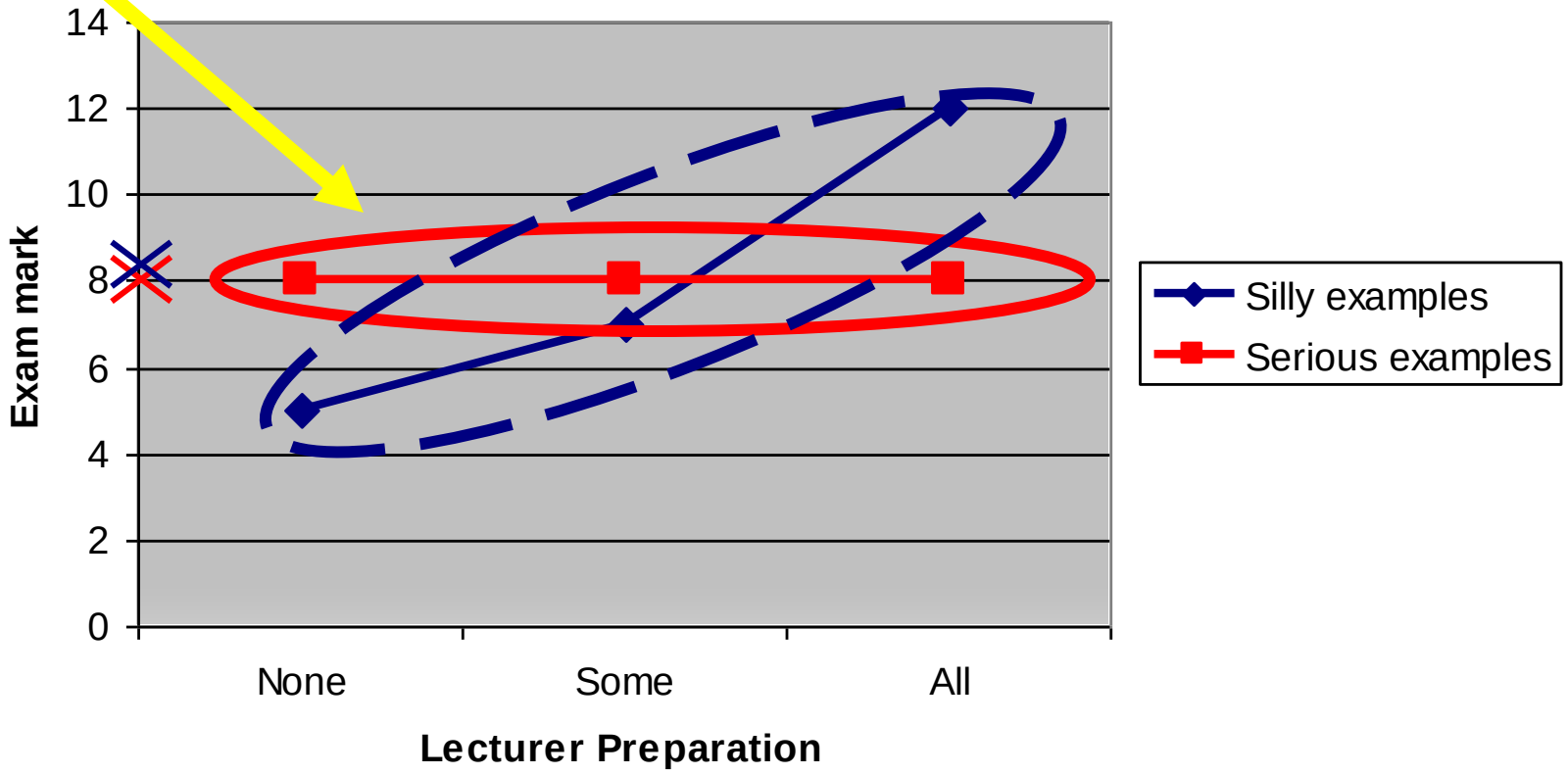
Main effect of lecturer preparation

When we average across example type, exam marks vary over lecturer preparation



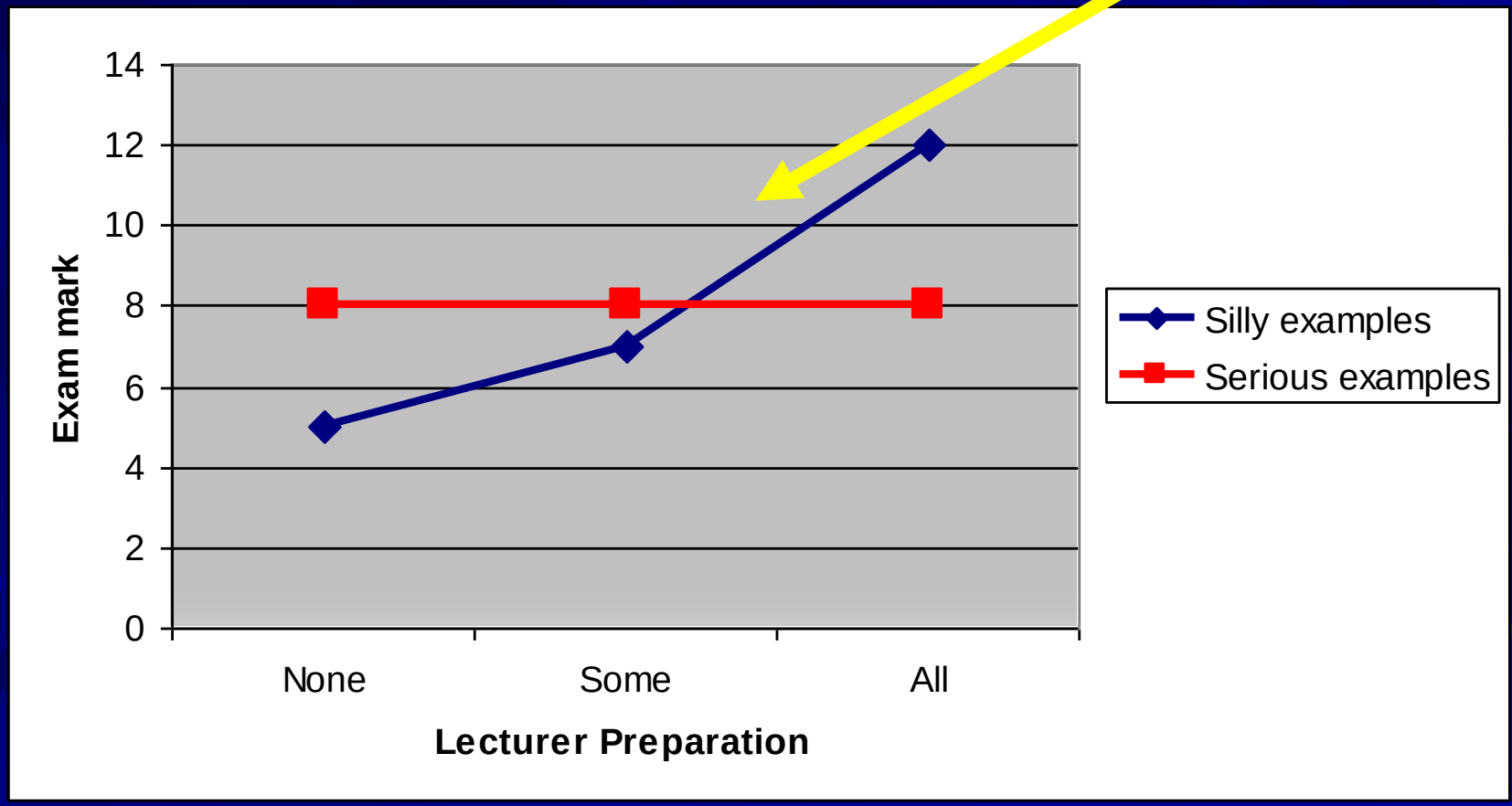
No main effect of example type

When we average across lecturer preparation, exams mark after silly examples are same as exam marks after serious examples

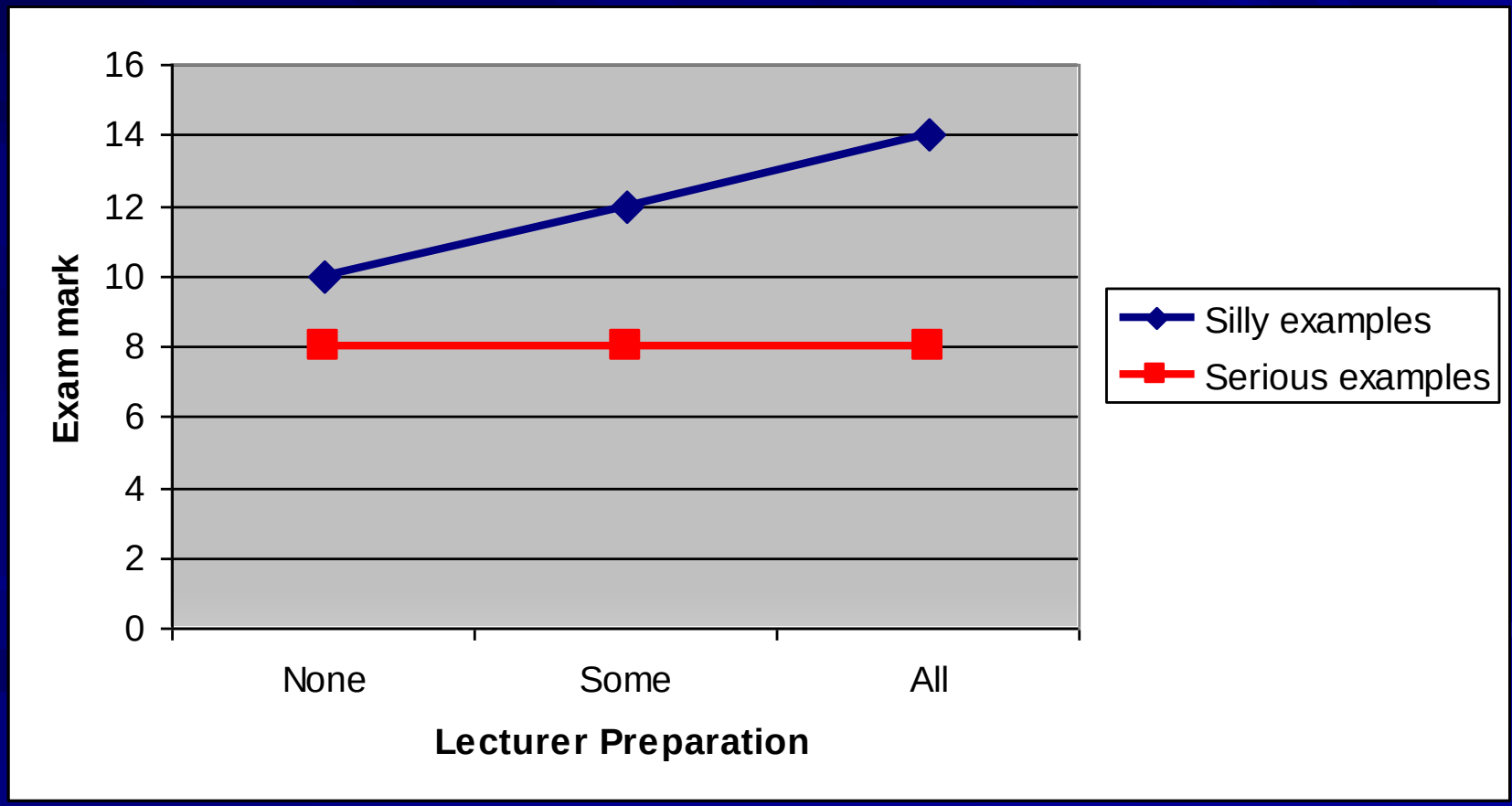


Interaction (disordinal)

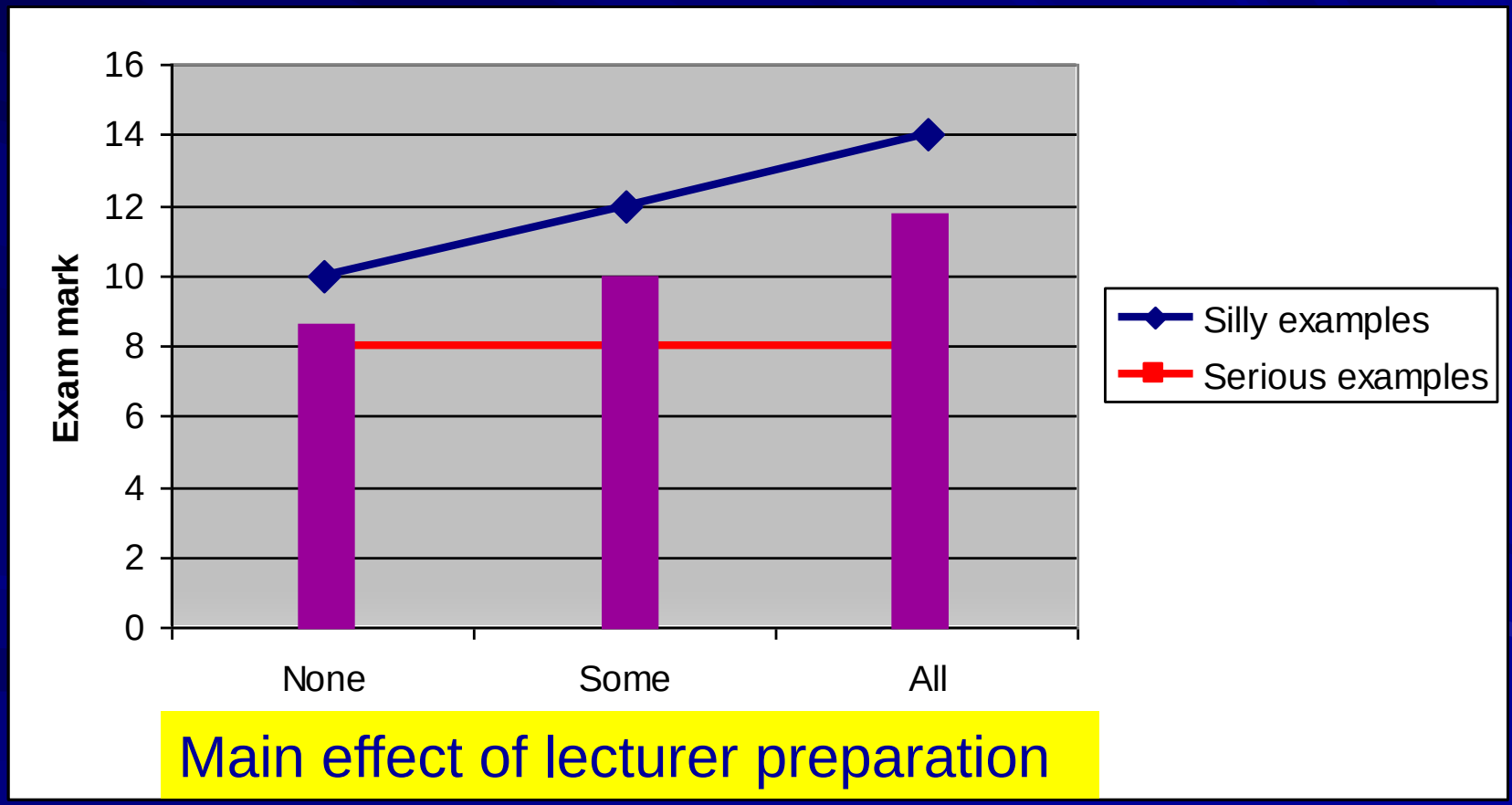
Effect of lecturer preparation depends upon example type



another possible outcome – 2 main effects and a (ordinal) interaction

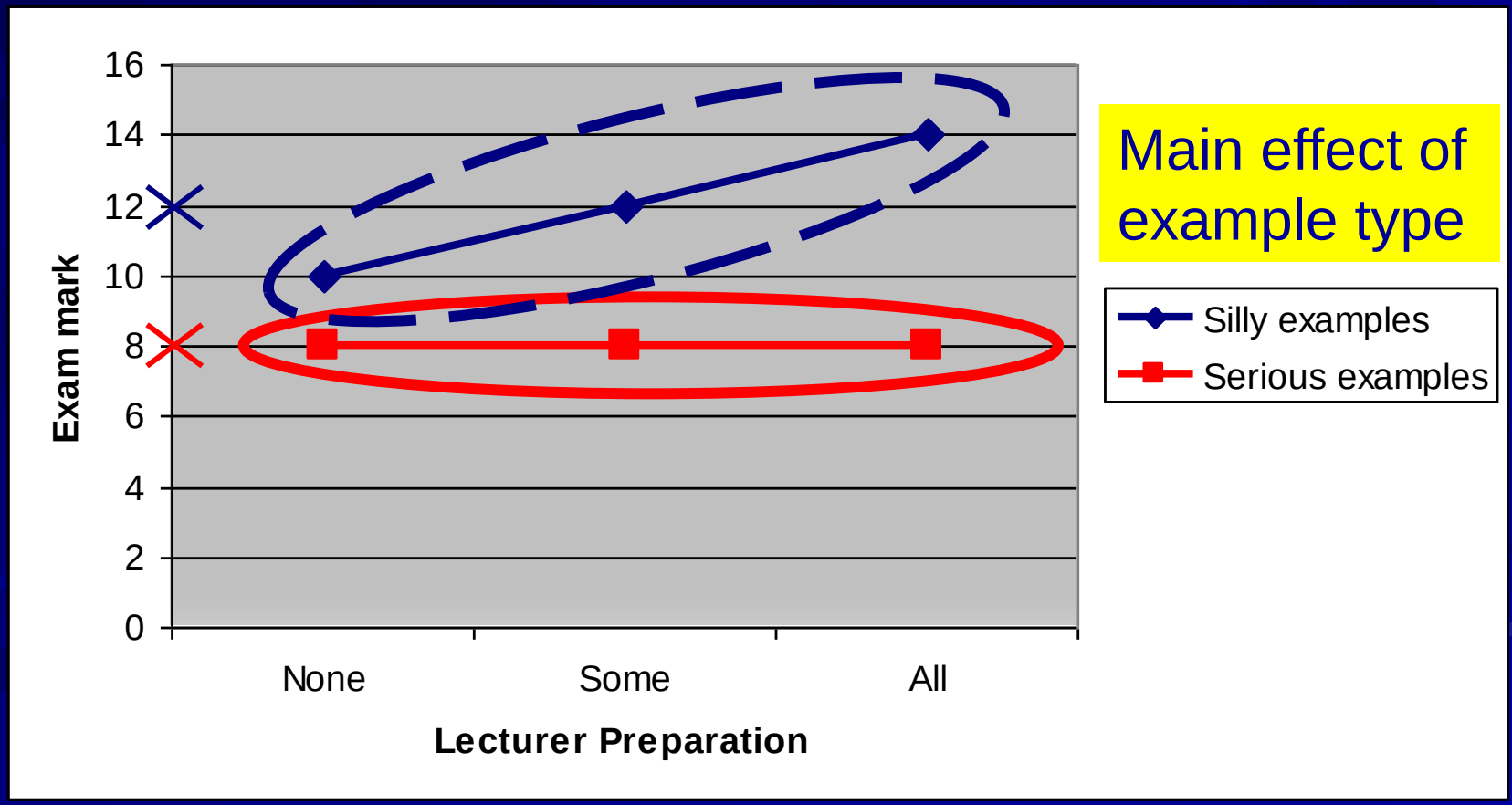


another possible outcome – 2 main effects and a (ordinal) interaction



Main effect of lecturer preparation

another possible outcome – 2 main effects and a (ordinal) interaction



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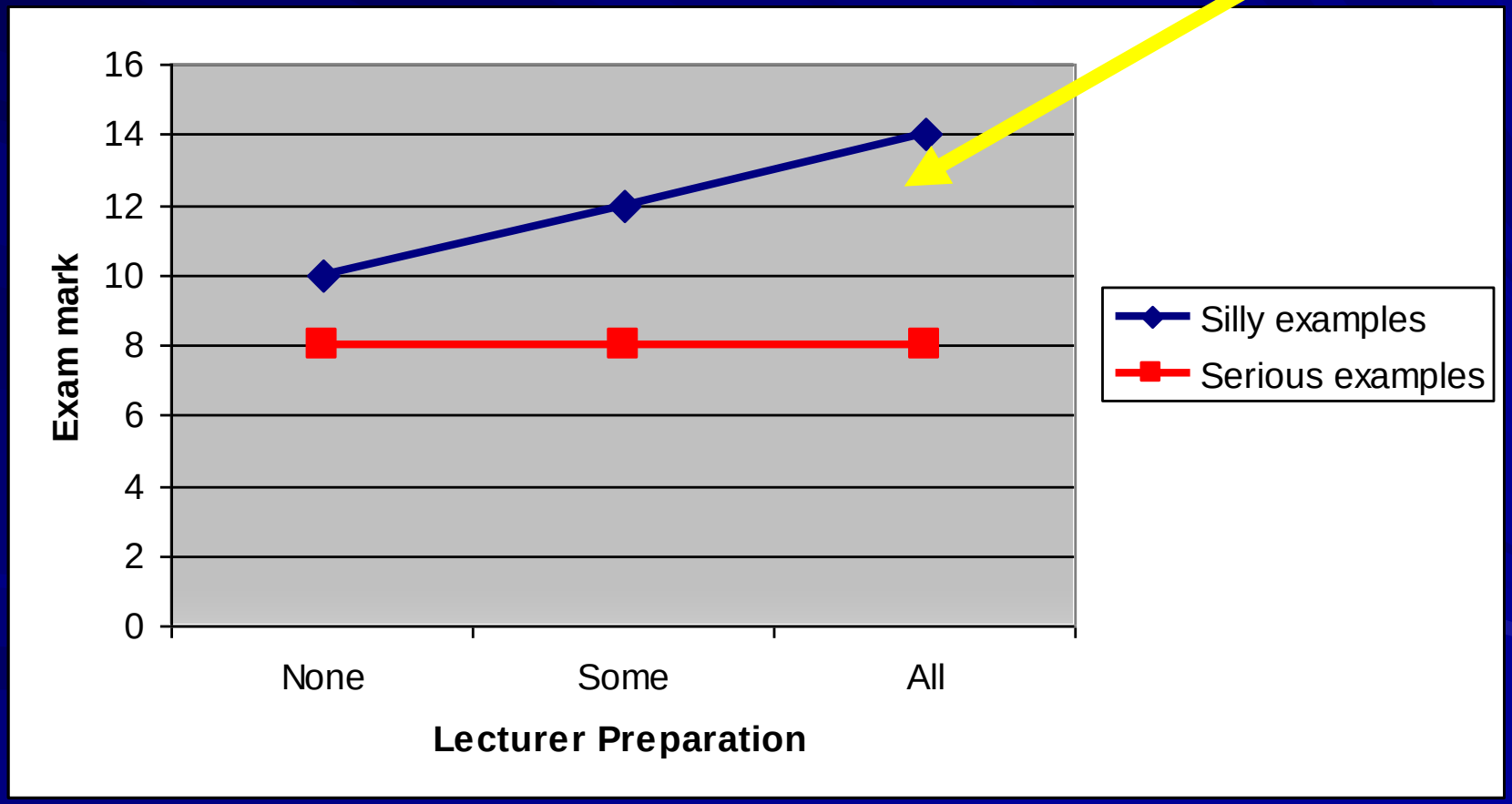
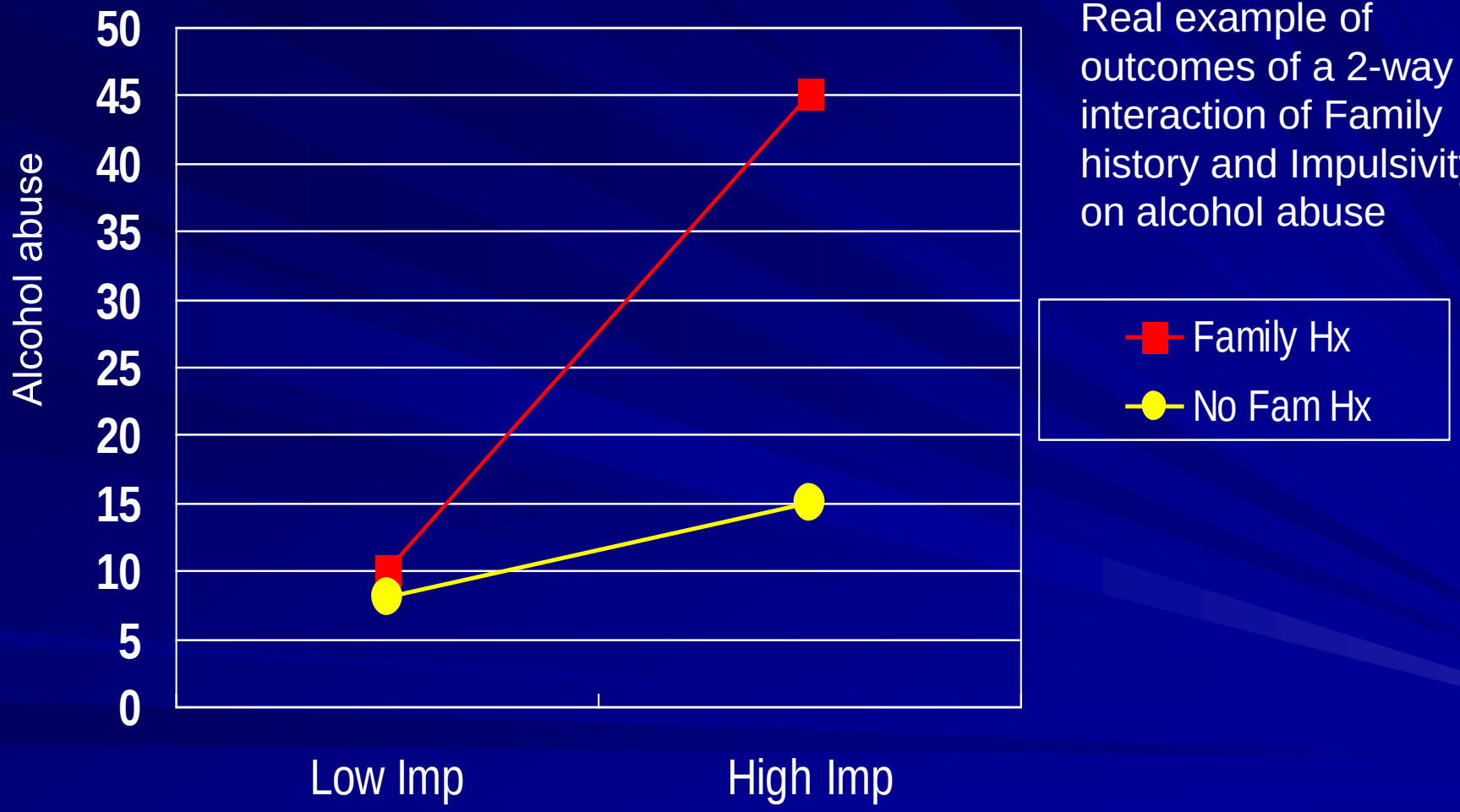
Interaction (ordinal)

Effect of lecturer preparation depends upon example type



Pidcock, B. W., Fischer, J. L., Forthun, L. F., & West, S. L. (2000). Hispanic and Anglo college women's risk factors for substance use and eating disorders. *Addictive Behaviors, 25*, 705-723.



Real example of outcomes of a 2-way interaction of Family history and Impulsivity on alcohol abuse

key points about factorial designs

- a factorial experiment has at least 2 factors,
  each with at least 2 levels
- for each pair of factors,
  there are two main effects and one interaction
- interactions and main effects can occur in any combination,
  they are ***independent***
- a significant interaction may ***qualify*** significant main effects:
  the simple effects of one IV depend on the level of the other IV under consideration

  → then, the main effects may need to be ***reinterpreted***
- interactions may be ***ordinal*** (lines don't cross) or
  disordinal (lines do cross)

A bit more detail in comparison

- One-way ANOVA
  - One IV
  - Group means compared to each other & to the grand mean
  - If they are different, there is an effect of the IV

Don't worry, we're going over this again slowly next week!!!

- Factorial ANOVA
  - Two or more IVs ("factors")
  - Effect of each factor examined at each level of the other factor ("factors are **crossed**")
  - Group means too vague now – you need to learn the difference between marginal and cell means
  - "**marginal means**" averaging across levels of other factors are compared to each other / grand mean to detect **main effects** of each IV
  - "**cell means**" within the levels of other factors are compared to each other to detect **simple effects** of an IV
  - Simple effects are compared to each other – if they are the same, no **interaction**
    - lines on a graph are parallel, difference of the differences = 0
  - Interaction means that one variable changes the effect of another on the DV
    - Lines on a graph are not parallel
    - Difference of the differences is not 0

- next week: logic and computations of factorial anova
  - revise chapter 11 and 12 of Howell
  - skim chapter 13

  - Revise Field Chapter 8 (don't worry too much about the SPSS part- i.e. 8.3 onwards)
  - Skim chapter 10.1 and 10.2 of Field

- tutes start next week – check notice board late this week for your allocation