G*power 3のwebページ

	🕙 Heinrich-Heine-Universität -	Institut für experimentelle Psychologie – Microsoft Internet Explorer	_ 0
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	 User guide: Type of Power Analysis 	However, in this case we would be grateful if you could send us a copy of your publication.	
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		Download G*Power	
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/'		3.0.10 for Windows XP or Vista (10 MB) [download] (Windows users: please	
/indow	VSはしろら	make sure to choose "unpack with folders" in your unzip tool)	
		Please note	
		If you use G*Power for your research, then we would appreciate if you would	
	<		>
6	ê	ダウンロード後、実行してインストール	



検定手法を選択

メニューに戻る前表示スライド

File Edit View Tests Calculator Help ここから検定手法を選択 Central and noncentral distributions Protocol of power analyses Exact ➢ Fisherの直接法やマクネ マー検定など • Ftest ▶ 分散分析 -Test family Statistical test t tests v. Correlation: Point biserial model ¥ t test Exact lvsis. F tests Y t tests required sample size - given α , power, and effect size ▶ 差のt検定 Y² tests z tests Output Parameters x2 test ? Tail(s) One ¥ Noncentrality parameter δ ? Determine => Effect size |r| 0.3 Critical t ➤ x2検定 0.05 ? α err prob Df Power $(1-\beta \text{ err prob})$ 0.95 ? Total sample size • Z test ? Actual power ▶ ノンパラメトリック検定で使う X-Y plot for a range of values Calculate

🚯 G*Power 3.0.10

メニュー

- <u>差の検定(t検定)の検出力</u>
- 相関係数の検出力
- 1元配置分散分析の検出力
- 2元配置分散分析の検出力
- <u>x2検定の検出力</u>
- <u>反復測定による分散分析の検出力</u>
- <u>分割プロット分散分析の検出力</u>

<u>メニューに戻る</u>前表示スライド



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TY	pe of p	ower ar	alysis –							
	priori: (Compu	te requi	red sample	e size - gi	ven α, pi	ower, and effe	ect size		<u> </u>
_ Inj	out Para	imeters	;				Output Pa	rameters]
				Tail(s)	One	~	Noncent	trality parameter δ		?
D	etermin	e =>	Effe	ct size r		0.3		Critical t		?
			α	err prob		0.05		Df		?
		Pow	er (1-β	err prob)		0.95		Total sample size		?
								Actual power		?
							V V mlot f	an a name of color		Calculate
							X-Y plot t	or a range of value:	>	Calculate



t検定の検出カ分析①

• ここから「t test」を選択

	ß	👌 G*Pow	er 3.0	.10				-		\ge
	E	ile <u>E</u> dit	⊻iew	<u>T</u> ests	<u>C</u> alculato	r <u>H</u> elp				
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N										
		-Test fami	lv —	- Stati	stical test					_
		t tests	· •	Cor	relation: P	oint biserial mod	el			7
	l	Exact								
	ſ	Ftests		nalysis –						
	Ļ	t tests		t requi	red sample	e size - given α, p	power, and effect size			1
		z tests		s			Output Parameters			
		· ·			Tail(s)	One 🗸	Noncentrality parameter δ		?	ן ה
		Determin		Eff.e.	et eine lul	0.9			,	
		Determin	ie =>	CHE	u size (r)	0.5	Chicart			4
				α	err prob	0.05	Df		?	_
			Pow	er (1-β	err prob)	0.95	Total sample size		?	•
							Actual power		?	ן
	l.									
							X-Y plot for a range of values	Calcu	ulate	



t検定の検出カ分析③

- 求めたいパラメータを決定
- A priori:~
 - ▶ 研究前に必要なnの大きさを知りたいとき
- Compromise : ~
 - αとβの比を指定する(余り使わない)
- Criterion : ~
 - αを求める(通常はα=0.01, 0.05
 で固定してるので不要)
- Post hoc: ~
 - 研究結果の検出力(1-β)を知り たいとき
- Sensitivity:~
 - ➤ 研究後に,結果から効果量 effect sizeを算出する
- 通常は, 赤字を利用する

1	<u>₿a</u> G*Power 3.0.10										
	<u>F</u> ile	<u>E</u> dit	⊻iew	<u>T</u> ests	<u>C</u> alculator	<u>H</u> elp					
	Cer	ntral ar	nd nonc	entral d	listributions	Protocol of p	ower analyses				
	Test family tatistical test t tests Mens: Difference between two independent means (two groups)										
		se of p	oner ar	ialysis -	4						
	Co	mpror	nise: Co	ompute	implied α &	power – given (3/α ratio, sam	ple size, and effect :	size 💌		
	A p Co Cri Pos Ser	oriori: (mpron iterion: st hoc: hsitivit	Comput nise: Co Compu Compu y: Comp	te requir ompute ute requ ute achie oute req	red sample implied α & iired α - giv eved power uired effect	size - given α, p power - given β en power, effect - given α, samp size - given α, j	ower, and effe } (α ratio, sam : size, and sam le size, and eff power, and sa	ect size ple size, and effect : nple size fect size mple size	size		
					β/α ratio	1		Df	?		
			San	nple size	e group 1	50		α err prob	?		
			San	nple size	e group 2	50		β err prob	?		
							Pc	wer (1-β err prob)	?		
							X-Y plot f	or a range of values	Calculate		

t検定の検出カ分析②

- さらに手法を選択
- Correlation~
 - ▶ 相関係数
- Means: ~(matched pairs)
 ➢ 対応のあるt検定
- Means: ~ (two groups)
 - ▶ 2標本t検定
- Means: ~ (one sample case)
 - ▶ 1標本t検定
- Generic t test
 - ▶ 包括的なt検定(余り使わない)
- ここではとりあえず、Means: ~(two groups)を選ぶ

<u>メニューに戻る|前表示スライド</u>

🟠 G*Pow	er 3.0.1	0						
<u>F</u> ile <u>E</u> dit	<u>V</u> iew (<u>T</u> ests <u>C</u>	alculato	r <u>H</u> elp				
Central a	nd nonce	ntral dist	ribution	s Protocol of	powe	er analyses		
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t tests	~	Correl	ation: Po	oint biserial mo	del			~
Type of p	ower ana	Correl	ation: Po	int biserial mo	del			
Compro	mise: Cor	n Means ¶¢Means	: Differei : Differei	nce between twi nce between twi	o dej o ind	pendent means (matched pairs lependent means (two groups))	
		Means - Cene	: Differei ericitites	nce from const ⊦	ant (one sample case)		
-Input Par	ameters -	- dent						
			Tall(S)	Une 🔽	1	Noncentrality parameter o		۲ -
Determin	ne =>	Effect	size r	0.3		Critical t		?
		β/	αratio	1	-11	Df		?
	То	otal samp	le size	111	-11	α err prob		?
						β err prob		?
						Power (1-β err prob)		?
						X-Y plot for a range of values		Calculate

t検定の検出カ分析④

- 各パラメータの設定
- Tail
 - ➢one=片側検定, two=両側検 定である. 通常はtwoを選択
- Effect size
 - >効果量. t検定では, Cohen (1988)にならって, 小=0.2, 中=0.5, 大=0.8に設定する. デフォルトでは0.5(中)となっ ているので, 何も知識がないと きは0.5にすると良い.
- α err prob

▶通常は0.05. 0.01でも良い.

- Power
 - ▶検出力で、デフォルトでは0.95 となっているが、0.8でもよい、 通常はαの4~5倍に設定する、 ここでは0.8
- Allocation ratio
 - ▶2群のnの比である.
- 全てが決まったらCalculateを ____ クリック
- <u>メニューに戻る</u>前表示スライド

🏠 G * Power 🗧	3.0.10				
<u>Eilē E</u> dit <u>V</u> ie	ew <u>T</u> ests	<u>C</u> alculato	r <u>H</u> elp		
Central and n	ioncentral d	listribution	s Protocol of po	wer analyses	
∼Test family−	Stati	istical test-			
tiests	Mea	ans: Differe	nce between two	independent means (two groups)) [
t lests Type of powe A priori: Con	mea r analysis npute requi	ans: Differe red sample	nce between two : size - given α, p	independent means (two groups) ower, and effect size) [
t lests Type of powe A pr bri: Con Input Parame	mea r analysis npute requi	ans: Differe red sample	nce between two : size – given α, p	independent means (two groups) ower, and effect size Output Parameters) [
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t lests Type of powe A priori: Con Input Parame Determine =	Mea r analysis npute requi ters	ans: Differe red sample Tail(s) [iect size d	nce between two : size - given α, p Two 0.5	independent means (two groups) ower, and effect size -Output Parameters Noncentrality parameter δ Critical t	
t lests Type of powe A prori: Con Input Parame Determine =	Mean Mean Mean Mean Mean Mean Mean Mean	ans: Differe red sample Tail(s) [ect size d [err prob]	nce between two : size - given α, p Two 0.5 0.05	independent means (two groups) ower, and effect size Output Parameters Noncentrality parameter δ Critical t Df	
t lests Type of powe A prori: Con Input Parame Determine =	Mea r analysis npute requi ters Effi α Power (1-β	ans: Differe red sample Tail(s) [ect size d err prob] err prob)	nce between two e size – given α, p Two 0.5 0.05 0.¢	independent means (two groups) ower, and effect size -Output Parameters Noncentrality parameter δ Critical t Df Sample size group 1	
t lests Type of powe A prori: Con Input Parame Determine =	Mea er analysis – npute requi sters – Eff α Power (1 -β location rat	ans: Differe red sample Tail(s) [ect size d err prob] err prob) [iio N2/N1	nce between two e size - given α, p Two 0.5 0.05 0.6 1	independent means (two groups) ower, and effect size Output Parameters Noncentrality parameter δ Critical t Df Sample size group 1 Sample size group 2	
t ests Type of powe A pr bri: Con Input Parame Determine =	Mean Power (1-β location rat	red sample Tail(s) [ect size d err prob] io N2 /N1 [nce between two : size - given α, p Two 0.5 0.05 0.4 1	independent means (two groups) ower, and effect size Output Parameters Noncentrality parameter δ Critical t Df Sample size group 1 Sample size group 2 Total sample size	
t ests Type of powe A priori: Con Input Parame Determine =	er analysis npute requi ters > Effi α Power (1-β location rat	ans: Differe red sample Tail(s) [ect size d err prob [err prob) [io N2/N1 [nce between two e size – given α, p Two 0.5 0.05 0.¢	independent means (two groups) ower, and effect size Output Parameters Noncentrality parameter δ Critical t Df Sample size group 1 Sample size group 2 Total sample size Actual nower	
t ests Type of powe A priori: Con Input Parame Determine =	er analysis npute requi eters > Effi α Power (1-β location rat	red sample Tail(s) ect size d err prob io N2/N1	nce between two e size - given α, p Two 0.5 0.05 0.¢	independent means (two groups) ower, and effect size Output Parameters Noncentrality parameter δ Critical t Df Sample size group 1 Sample size group 2 Total sample size Actual power	

t検定の検出カ分析④

- 必要な症例数が算出される
- つまり、効果量0.5(中等度)を保証した条件で (α=0.05かつ検出力0.8としたとき、症例数は64例ずつ、計128例必要と算出される.



相関の検出カ分析

- 相関の場合は,
 - ≻[Test family]=t tests
 - \succ [Statistical test]=Correlation : ~

を選ぶ.

- あとは「<u>t検定の検出力分析③</u>」以 降に従う.
- Effect size |r| は,
- /****\0.1
- 中0.3
- 大0.5
- とする. 何の知識もないときは, デ フォルトの0.3を使用



1元配置分散分析の検出カ分析①

🙀 G*Power 3.0.10

File Edit View Tests Calculator Help Central and noncentral distributions | Protocol of power analyses [Test family]=F testsの後, これを選ぶ、 Test family Statistical test F tests ANOVA: Fixed effects omnibus one-way ANOVA: Fixed effects, omnibus, one-way Type of power analy ANOVA. Fixed effects, special, main effects and interactions A priori: Compute r ANOVA: Repeated measures, between factors ANOVA: Repeated measures, within factors ANOVA: Repeated measures, within-between interaction Input Parameters Hotellings T²: One group mean vector Determine => Hotellings T^z: Two group mean vectors MANOVA: Global effects MANOVA: Special effects and interactions Power (MANOVA: Repeated measures, between factors MANOVA: Repeated measures, within factors Num MANOVA: Repeated measures, within-between interaction Multiple Regression: Omnibus (R² deviation from zero) Multiple Regression: Special (R² increase) Variance: Test of equality (two sample case) Generic F test X-Y plot for a range of values Calculate メニューに戻る前表示スライド

1元配置分散分析の検出カ分析②

•各パラメータの設定

• Effect size

▶小0.1, 中0.25, 大0.4▶デフォルトでは0.25

• α err prob

≻通常は0.05

Power

▶0.95か0.8. どちらでも 良い

• Number of groups ▶水準(比較群)の数

- 0 X 🙀 G*Power 3.0.10 File Edit View Tests Calculator Help Central and noncentral distributions | Protocol of power analyses critical F = 3.0540.8 0.6 0.4 0.2 Test family Statistical test ¥ ¥ ANOVA: Fixed effects, omnibus, one-way F tests Type of power analysis ¥ A priori: Compute required sample size - given α , power, and effect size Output Parameters Input Parameters 0.25 9.937500 Determine => Effect size f Noncentrality parameter λ 0.05 Critical F 3.054004 α err prob 0.8 2 Power (1-β err prob) Numerator df 156 Number of groups З Denominator df Total sample size 159 0.804887 Actual power X-Y plot for a range of values Calculate

<u>メニューに戻る</u>前表示スライド

2元配置分散分析の検出カ分析①

		<u>Ba</u> G*Power 3.0.10	
•	[lest family]=F testsの後,	<u>Eile Edit View T</u> ests <u>C</u> alculator <u>H</u> elp	
	これを選ぶ	Central and noncentral distributions Protocol of power analyses]
		Test familyStatistical test	
		F tests ANOVA: Fixed effects, special, main effects and interactions	~
		CType of nower analy	
		A priori: Compute nanova, seneared measures netween rations	
		ANOVA: Repeated measures, within factors	J.
		Input Parameters ANOVA: Repeated measures, within-between interaction	h
		Determine => Hotellings T ² : Two group mean vectors	
		MANOVA: Global effects	
		MANOVA: Special effects and interactions	
		MANOVA: Repeated measures, within factors	
		MANOVA: Repeated measures, within-between interaction	
		Num Multiple Regression: Special (R ² increase)	
		Variance: Test of equality (two sample case)	
		- Generic F test	
(二	ューに戻るI前表示スライド	X-Y plot for a range of values	late

2元配置分散分析の検出カ分析②

- 2要因のうち,水準数の多い方を 計算する
- A priori: ~の例
- Effect size
 - ▶小0.1, 中0.25, 大0.4▶ここでは0.4
- α err prob ≻通常は0.05
- Power
 - ▶0.95か0.8. どちらでも良い
- Numerator df
 - ▶ (水準数-1)を入力
 ▶ 滅多にないと思うが,交互作用の検出力の時は,(A水準-1)×(B水準-1)の数を入力
- Number of groups
 - ▶水準(比較群)の数
 - >交互作用の検出力の時は、A水準 ×B水準の数を入力

<u>メニューに戻る</u>前表示スライド



2元配置分散分析の検出カ分析③

🙀 G*F	G*Power 3.0.10								
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Centr	al and non	central d	listribution	s Protocol of p	ower analyses				
		cri	tical F = 2.	73749					
0.6 -	0.6 0.4 0.2 0 0 0 0 0 0 0 0 0 0								
) '	1	2 .	4	. 6	. 8		10	
Test f	amily	Stat	istical test						
Ftest	s 💙	AN	OVA: Fixed	effects, special, I	main effects ar	nd interactions		*	
Туре	of power a	nalysis							
A pri	ori: Compu	ite requi	red sample	e size - given α, p	ower, and effe	ct size		*	
Input	Parameter	s			Output Par	ameters			
Deter	mine =>	Eff	fect size f	0 .4	Noncent	rality parameter	λ	11.680000	
		α	err prob	0.05		Critical	F	2.737492	
	Pov	ver (1-β	err prob)	0.8		Denominator (df	69	
		Num	erator df	3		Total sample siz	ze	73	
	N	lumber o	of groups	4		Actual powe	er	0.805273	
					X-Y plot f	or a range of valu	ies	Calculate	

- 全必要数は73例となる.
- 例えば、A要因が4水準(群)、B 要因が3水準の時は、全12水 準なので73/12=6.08…となり、 7例ずつ必要となる
- 例えば、A要因が4水準(群)、B 要因が2水準の時は、全8水準 なので73/8=9.125…となり、 10例ずつ必要となる



x2検定の検出カ分析

- χ2検定の場合は,
 - ≻[Test family]=χ2 tests
 - ≻[Statistical test]=Goodnessof-fit~

を選ぶ.

- あとは「<u>t検定の検出力分析③</u>」
 以降に従う.
- Effect size w は,
- */*]\0.1
- 中0.3
- 大0.5
- とする. 何の知識もないときは, デフォルトの0.3を使用

メニューに戻る前表示スライド



反復測定による分散分析の検出力①

- 通常の反復測定(下の例)ANOVAを 想定します.
- [Test family]=F testsの後, まずこれ を選びます

	1st	2nd	3rd
А	10	11	13
В	12	15	14
С	10	13	16



反復測定による分散分析の検出力②



反復測定による分散分析の検出力③

- 結果は86となる.
- 水準が3なので、86/3=28.666…となり、 29人を対象とする

🚡 G*Power 3.	G*Power 3.0.10									
<u>F</u> ile <u>E</u> dit <u>V</u> iew	<u>T</u> ests	<u>C</u> alculator	<u>H</u> elp							
Central and nor	ncentral d	listributions	Protocol of po	wer analyses						
	ritical F =	= 3.95321								
0.6 - 0.4 - 0.2 - B	×	α-								
0		5	1	0	15	20				
Test family	Stati	stical test								
F tests	ANG	OVA: Repeate	ed measures, wi	thin factors						
Type of power a	analysis									
A priori: Comp	ute requi	red sample s	ize – given α, p	ower, and effe	ct size					
Input Paramete	rs			Output Pa	rameters]				
Determine =>) Eff	fect size f	0.25	Noncent	trality parameter λ	8.062500				
	α	err prob	0.05		Critical F	3.953209				
Po	wer (1-β	err prob)	0.8		Numerator df	1.000000				
	Number o	of groups	1		Denominator df	85.000000				
	Re	petitions	З		Total sample size	86				
Corr am	iong rep r	neasures	0		Actual power	0.801579				
Nonsph	ericity cor	rection e	0.5							
			(X-Y plot f	or a range of values	Calculate				



分割プロット(反復測定)分散分析の検出力①

- [Test family]=F testsの後, まずこれを 選びます
- 分割プロットの例(下表)
 - A~Fの6人を対象とした例です.a1~a3
 の条件は全被検者に行い,b1はA~C, b2はD~Fのみ行うとなります.

		b1			b2			
	a1	a2	a3		a1	a2	a3	
А	10	9	7	D	6	5	10	
В	11	8	8	Е	8	6	11	
С	10	9	6	F	7	7	15	



分割プロット(反復測定)分散分析の検出力②



分割プロット(反復測定)分散分析の検出力③

- 結果は44となる.
- 水準が3なので、44/3=14.666…
 となり、15人を対象とする

🚡 G * Power 🗧						
<u>File E</u> dit <u>V</u> ie	ew <u>T</u> ests	<u>C</u> alculator	<u>H</u> elp			
Central and n	oncentral d	listributions	Protocol of po	wer analyses		
	critical F =	= 4.07265				
0.6 -		α				
0		5	10)	15	20
Test family	Stati	istical test				
F tests		OVA: Repeate	d measures, be	tween factors		~
Type of powe	r analysis -					
A priori: Con	npute requi	red sample s	ize - given α, p	ower, and effe	ct size	~
 Input Parame	ters			Output Par	ameters	
Determine =	> Efi	fect size f	0.25	Noncent	rality parameter λ	8.250000
	α	err prob	0.05		Critical F	4.072654
	Power (1-β	err prob)	0.8		Numerator df	1.000000
	Number o	of groups	2		Denominator df	42.000000
	Re	petitions	3		Total sample size	44
Corr among rep measures			0		Actual power	0.801247
			(X-Y plot fo	or a range of values	Calculate