

ABDUL LATIF JAMEEL

Poverty Action Lab



TRANSLATING RESEARCH INTO ACTION

J-PAL Advanced Course in Experimental Evaluations

Course Material



University of Cape Town

6 – 7 July 2011



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Advanced Course in Experimental Evaluation Course Programme

J-PAL Africa, University of Cape Town
July 6-7, 2011

Wednesday, July 6

9:00 AM – 9:15 AM	Welcome Remarks
9:15 AM – 11:00 AM	Lecture 1, “The why and how of randomised experiments” Marc Gurgand <i>Suggested background reading:</i> <i>(i) Cohen & Dupas (2010) “Free Distribution or Cost Sharing”;</i> <i>(http://www.povertyactionlab.org/sites/default/files/publications/55_Dupas_Free_Distribution_or_Cost-Sharing.pdf)</i> <i>(ii) Duflo, Kremer & Robinson (2010) “Nudging Farmers to use Fertilizer”;</i> <i>(econ-www.mit.edu/files/6170)</i> <i>(iii) Gurgand, Crepon & Behaghel (2011) “Private and Public Provision of Counseling to Job-Seekers”</i> <i>(http://www.parisschoolofeconomics.com/behaghel-luc/PrivatePublicCounseling_%2020110331.pdf)</i>
11:00 AM – 11:15 AM	<i>Coffee Break</i>
11:15 AM – 12:30 PM	Group Exercise: Randomisation Design
12:30 PM – 1:30 PM	<i>Lunch</i>
1:30 PM – 3:15 PM	Lecture 2, “Outcome measures” Rachel Glennerster <i>Background reading:</i> <i>Duflo et al (2006) “Women as Policymakers”;</i> (econ-www.mit.edu/files/792) <i>Glennerster et al (2011) “Community Driven Development in Sierra Leone.”;</i> <i>(www.povertyactionlab.org/node/4127)</i>
3:15 PM – 3:30 PM	<i>Coffee Break</i>
3:30 PM – 5:00 PM	Lecture 3, “Threats to Validity” Michael Kremer <i>Background reading:</i> <i>Kremer et al (2011) “Worms at Work: Long-run Impacts of Child Health Gains”</i> <i>(www.cgdev.org/doc/events/KLPS-Labor_2011-05-16-Circulate.pdf)</i>
7:00 PM	Dinner (venue to be determined)

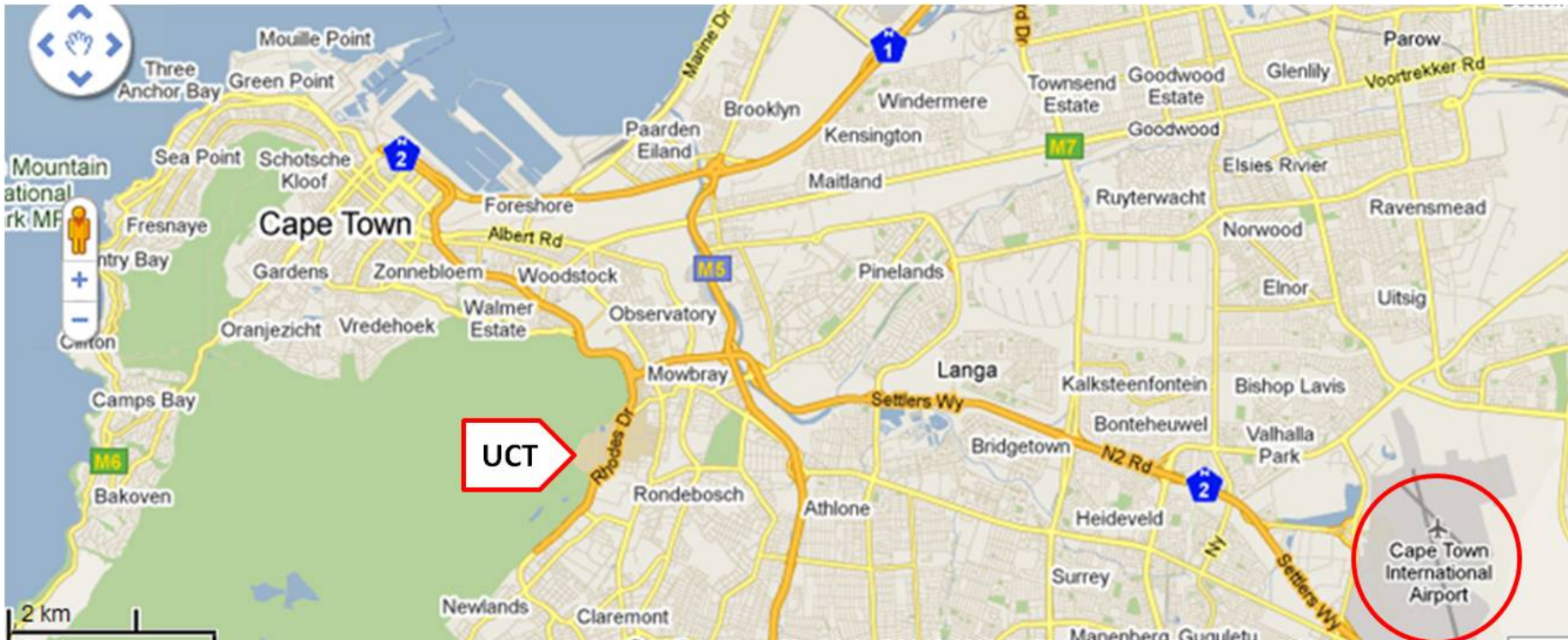


Thursday, July 7

8:30 AM – 10:00 AM	Lecture 4, “Power Calculation” Marc Gurgand <i>Background reading:</i> <i>Duflo, Glennerster & Kremer (2006) “Using Randomization in Development Economics Research: A Toolkit”; SECTION 4</i> <i>(http://econ-www.mit.edu/files/806)</i>
10:00 AM – 10:15 PM	<i>Coffee Break</i>
10:15 AM – 11:30 PM	Group Exercise: Power calculation
11:30 AM – 12:30 PM	Research Presentations Course Participants
12:30 PM – 1:15 PM	<i>Lunch</i>
1:15 PM – 2:45 PM	Lecture 5, “RCTs and Structural Modeling” Michael Kremer <i>Background reading:</i> <i>Kremer et al (2010) “Spring Cleaning: Rural Water Impacts, valuation and property rights institutions”</i> <i>(www.economics.harvard.edu/faculty/kremer/files/Springs-Paper_2010-05-11.pdf)</i>
2:45 PM – 3:00 PM	<i>Coffee Break</i>
3:00 PM – 4:00 PM	Research Presentations Course Participant
4:00 PM – 5:00 PM	Discussion Round: Practical tips for running randomised evaluations Rachel Glennerster
5:00 PM – 5:15 PM	Closing Remarks



Cape Town – University of Cape Town



Directions to UCT Middle Campus from the airport

To reach the university from the airport, proceed on the N2 towards Cape Town and take the Muizenberg (M3) off-ramp. Continue until you reach and turn off at the Woolsack Drive / University of Cape Town off ramp. Go straight at the traffic lights on Woolsack Drive and enter middle campus. Follow Cross Campus Road until you come to a stop sign. Take a left and after 100m you see the parking lot for the All Africa House and New Economics Building on the left side (**J2/3** on map on next page).

Directions to UCT Middle Campus from Cape Town

UCT's Middle Campus (Groote Schuur Campus) is situated on the slopes of Devil's Peak in the suburb of Rondebosch. To reach the middle campus from the city, drive along De Waal Drive or Eastern Boulevards, passing Groote Schuur Hospital on the way. Just past the hospital the road forks. Take the right-hand fork (M3 to Muizenberg). Just beyond Mostert's Mill (windmill) on your left, take the Woolsack Drive / University of Cape Town turn-off. Go straight at the traffic lights on Woolsack Drive and enter middle campus. Follow the road until you come to a stop sign. Take a left and after 100m you see the parking lot for the All Africa House and New Economics Building on the left side (**J2/3** on map on next page).



UCT Lower and Middle Campus: New Economics Building – Advanced Course Venue





J-PAL Lecturers

Rachel Glennerster

Executive Director , J-PAL Global
Scientific Director, J-PAL Africa

Rachel Glennerster is Executive Director of J-PAL. Her current research includes randomized evaluations of community driven development in Sierra Leone, empowerment of adolescent girls in Bangladesh, and health, education, and microfinance in India.

Rachel Glennerster helped establish Deworm the World of which she is a board member. Before joining J-PAL, she worked on debt relief and the reform of the international monetary system at the International Monetary Fund, and financial regulation at the Harvard Institute for International Development and the UK Treasury.



Marc Gurgand

Associate Professor
Paris School of Economics
Scientific Director, J-PAL Europe

Marc Gurgand is an Associate Professor at the Paris School of Economics. His research focuses on labor market policies, schooling and inequality in both developing and developed countries. He is currently conducting randomized evaluations of counseling schemes focused on the unemployed and welfare recipients. He also has a research program studying inequality in China.



Michael Kremer

Gates Professor of Developing Societies
Harvard University

Michael Kremer is the Gates Professor of Developing Societies in the Department of Economics at Harvard University and Senior Fellow at the Brookings Institution. He was named a Young Global Leader by the World Economic Forum. Kremer's recent research examines education and health in developing countries, immigration, and globalization.





List of Participants

	Name	First Name	Organization	County
1	Ardington	Cally	University of Cape Town	South Africa
2	Bawakyillenui	Simon	University of Ghana	Ghana
3	Branson	Nicola	University of Cape Town	South Africa
4	Burger	Ronelle	Stellenbosch Univ	South Africa
5	Burns	Justine	University of Cape Town	South Africa
6	Buyinza	Faisal	Makerere University	Uganda
7	Chete	Louis	Nigerian Institute of Social and Economic Research	Nigeria
8	Gash	Fikre	Addis Ababa University	Ethiopia
9	Gwatidzo	Tendai	Witswatersrand Univ	South Africa
10	Hathie	Ibrahima	USAID Economic Growth Project	Senegal
11	Hisali	Eria	Makerere University	Uganda
12	Jasseh	Momodou	Medical Research Council	Gambia
13	Kasirye	Ibrahim	Economic Policy Research Centre	Uganda
14	Keswell	Malcolm	University of Cape Town	South Africa
15	Leibbrandt	Murray	University of Cape Town	South Africa
16	Masanjala	Winford	Ministry of Finance	Malawi
17	Niane	Aifa	Initiative Prospective Agricole et Rurale	Senegal
18	Okidi	John	International Development Research Centre	Uganda
19	Pellicer Gallardo	Miquel	University of Cape Town	South Africa
20	Piraino	Patrizio	University of Cape Town	South Africa
21	Sadou	Ibrahim	CRES	Senegal
22	Taylor	Stephen	Stellenbosch Univ	South Africa
23	Thegeya	Aaron	World Bank	Kenya
24	van der Westhuizen	Carlene	University of Cape Town	South Africa
25	van Fintel	Dieter	Stellenbosch Univ	South Africa
26	Visser	Martine	University of Cape Town	South Africa
27	Weldesilassie	Alebel	Ethiopian Development Research Institute	Ethiopia
28	Wittenberg	Martin	University of Cape Town	South Africa



Case Study 1

ABDUL LATIF JAMEEL

Poverty Action Lab



TRANSLATING RESEARCH INTO ACTION



Case: Extra Teacher Program Designing an evaluation to answer three key education policy questions

This case study is based on the paper “Peer Effects and the Impact of Tracking: Evidence from a Randomized Evaluation in Kenya,” by Esther Duflo (MIT), Pascaline Dupas (UCLA), and Michael Kremer (Harvard)

J-PAL thanks the authors for allowing us to use their paper



Are Contract Teachers Effective?

The increasing use of contract teachers has been one of the most significant policy innovations in providing primary education in developing countries, but it has also been highly controversial.

Supporters say that using contract teachers is an efficient way of expanding education access and quality to a large number of first-generation learners. Knowing that the school committee's decision of whether or not to rehire them the following year may hinge on performance, contract teachers are motivated to try harder than their tenured government counterparts. Contract teachers are also often more similar to their students in terms of geographic and cultural roots as well as socio-economic status. Opponents argue that using under-qualified and untrained teachers may staff classrooms, but will not produce learning outcomes. Furthermore the use of contract teachers de-professionalizes teaching, reduces the prestige of the entire profession, and reduces motivation of all teachers. Even if it helps in the short term, it may hurt efforts to recruit highly qualified teachers in the future.

While the use of contract teachers has generated much controversy, there is very little rigorous evidence regarding the effectiveness of contract teachers in improving student learning outcomes.

The Extra Teacher Program Randomized Evaluation

In January 2005, International Child Support Africa initiated a two year program to examine the effect of contract teachers on education in Kenya. Under the program, ICS gave funds to 140 local school committees to hire one extra contract teacher to teach an additional first grade class. The purpose of this intervention was to address three challenges: class size, teacher accountability, and heterogeneity of ability. The evaluation was designed to measure the impact of class-size reductions, the relative effectiveness of contract teachers, and how tracking by ability would impact both low and high-achieving students. The following discussion topics consider the experimental designs which could test the impact of this intervention on educational achievement, as well as which of these changes in the school landscape is primarily responsible for improved student performance.

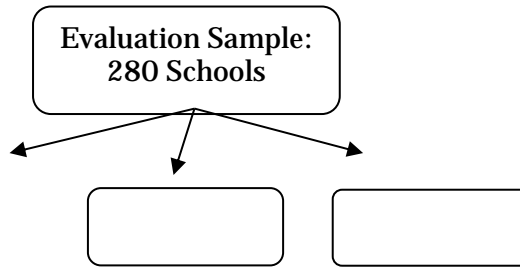
Addressing Multiple Research Questions through Experimental Design



Different randomization strategies may be used to answer different questions. What randomization strategy could be used to evaluate the following questions?

Assume that we have 280 schools in our evaluation sample and that each school has only one class per grade, each with 60 students.

In each of the following discussion topics, use a tree (like the one below) to show the appropriate randomization design



Remember that to answer each question, we have to compare groups that differ **only** along the variable of interest, e.g. to estimate the effect of tracking we have to keep class size and teacher type constant.

Draw the design tree and show which groups to compare to answer each of the following questions:

Discussion Topic 1: Testing the effectiveness of contract teachers

1. What is the relative effectiveness of contract teachers versus regular government teachers?

Discussion Topic 2: Looking at more general approaches of improving education. In addition to the effect of contract vs. government teachers draw a design tree that answers the following two questions in the **same** study design.

2. What is the effect of smaller class sizes on student performance?
3. What is the impact of grouping students by ability on student performance?

Discussion Topic 3: Addressing **all three** questions with a single evaluation

4. Could a single evaluation explore all these issues at once? Y/N
5. What randomization strategy could do so?



Case Study 2:



**Case: Deworming in Kenya
Managing threats to experimental integrity**

This case study is based on Edward Miguel and Michael Kremer, “Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities,”
Econometrica 72(1): 159-217, 2004

J-PAL thanks the authors for allowing us to use their paper



Primary School Deworming Program

Worm infections account for over 40 percent of the global tropical disease burden. Infections are common in areas with poor sanitation. More than 2 billion people are affected. Children, still learning good sanitary habits, are particularly vulnerable: 400 million school-age children are chronically infected with intestinal worms.

International Child Support Africa (ICS) implemented the Primary School Deworming Program (PSDP) in the Busia District in western Kenya, a densely-settled region with high worm prevalence. Treatment followed WHO guidelines. The medicine was administered by public health nurses from the Ministry of Health in the presence of health officers from ICS.

The PSDP was expected to affect health, nutrition, and education. To measure impact, ICS collected data on a series of outcomes: prevalence of worm infection, worm loads (severity of worm infection); self-reported illness; and school participation rates and test scores.

Evaluation design — the experiment as planned

Discussion Topic 1: Randomization Design

1. What should the unit of randomization be?
2. Opponents argue that it is unethical to deny students access to deworming medicine. Is this a valid argument? What RCT design can take into account ICS's resource and capacity constraints and may address ethical concerns?

Figure 1: The planned experiment: the PSDP treatment timeline showing experimental groups in 1998 and 1999

	1998	1999	2001
Group 1	Treatment	Treatment	Treatment
Group 2	Comparison	Treatment	Treatment
Group 3	Comparison	Comparison	Treatment



Managing Attrition

Attrition is when people join or drop out of the sample—both treatment and comparison groups—over the course of the experiment. One common example in clinical trials is when people die; so common indeed that attrition is sometimes called experimental mortality.

Discussion Topic 2: Managing Attrition

You are looking at the health effects of deworming. In particular you are looking at the worm load (severity of worm infection). Worm loads are scaled as follows: Heavy worm infections get a worm load score of 3, medium worm infections a score of 2, and light infections a score of 1.

There are 30,000 children: 15,000 in treatment schools and 15,000 in comparison schools. After you randomize, the groups are equivalent: children from each of the three categories are equally represented.

Protocol compliance is 100 percent: all children who are in the treatment get treated and none of the children in the comparison are treated. Deworming at the beginning of the school year results in a worm load of 1 at the end of the year due to re-infection during the year. Children who have a worm load of 3 only attend half the time and drop out of school by the end of the year if they are not treated. The number of children in each worm-load category is shown for both the pretest and posttest.

	<i>Pretest</i>		<i>Posttest</i>	
<i>Worm Load</i>	Treatment	Comparison	Treatment	Comparison
3	5,000	5,000	0	Dropped out
2	5,000	5,000	0	5,000
1	5,000	5,000	15,000	5,000
Total children tested at school	15,000	15,000	15,000	10,000



1. Comparing pre- and post-test results
 - a. What is the difference in average **pretest** worm load between treatment and comparison group? What does this tell us?
 - b. What is the difference in average **posttest** worm load between treatment and comparison group?
 - c. Is this difference in means an accurate estimate of the impact of the program?
 - d. If it is not accurate, does it overestimate or underestimate the impact?
 - e. What is the size of the attrition bias of the program (and under what assumptions?)
 - f. How can you solve the problem to get a better estimate of the program impact?
2. The study also looked at the effect on test scores.
 - a. Would differential attrition bias this outcome?
 - b. Would the impact be underestimated or overestimated?
3. There are other methods to estimate program impact, such as pre-post, simple difference, differences in differences, and multivariate regression.
 - a. Discuss if and how the issues explored above exist for each of these methods.

Spillovers

People assigned to the control group may benefit indirectly from those receiving treatment. For example, a program that distributes insecticide-treated nets may reduce malaria transmission in the community, indirectly benefiting those who themselves do not sleep under a net. Such effects are called externalities or spillovers.

Discussion Topic 3: Managing spillovers

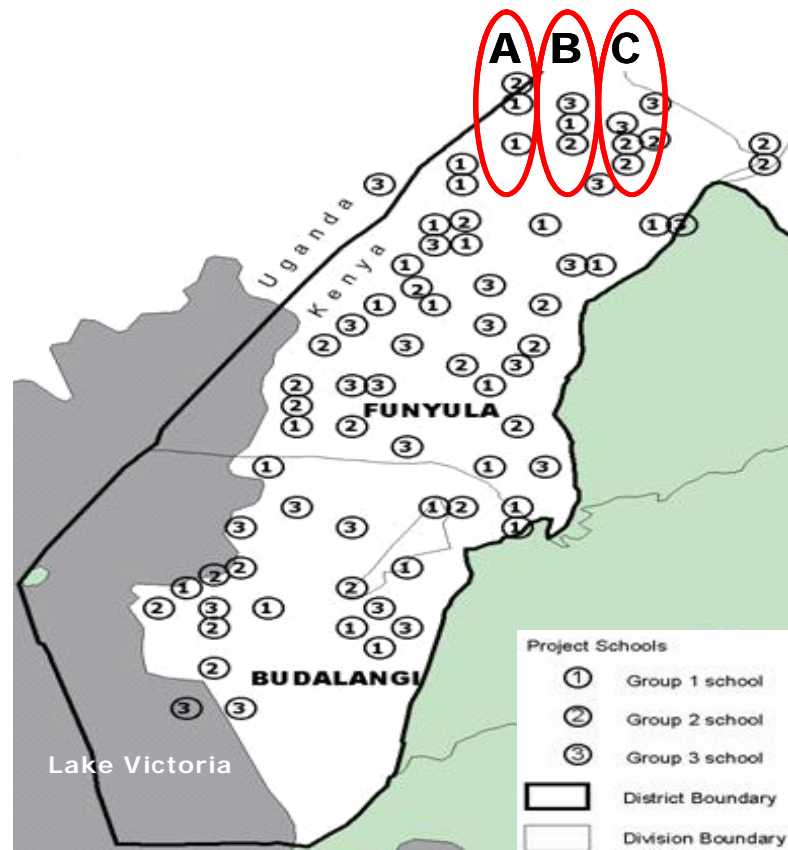
In the PSPD, randomization was at the school level. People in the evaluation areas lived on farms close together. Clusters of farms can be divided into areas of 3km radius. Three such areas—A, B, and C—are shown in the diagram on the following page. Farms are close enough for children from neighboring farms to play with one another. Families also had a choice of primary schools.

There are three schools in area A, three in area B, and five in area C. It was common for children from neighboring farms, or even siblings, to go to different schools. Some of the schools in each cluster were treatment, others were control. Group 1 schools were the treatment in year 1, and group 2 and 3 were the comparison.



Each school has 100 children. Protocol compliance is 100 percent: all the children in treatment get treated and all the children in comparison do not get treated.

1. You estimate impact by comparing average worm loads at treatment and comparison schools.
 - a. Would this estimate be an underestimate or overestimate of the impact?
2. The treatment density is the proportion of treated to untreated in a given grouping of people.
 - a. Is it possible for you to capture spillover effects within the schools?
 - b. Is it possible for you to capture cross-school spillovers?
3. Randomization level
 - a. If you had randomized at the individual level, what could you have done to capture interpersonal spillover?
 - b. If you had randomized at the school, as is the case in this example, what can you do to capture cross-school spillovers?





STATA Exercise

J-PAL Africa Advanced Training, 6 -7 July 2011

STATA Exercise

1) Random Assignment (20min)

Study Background: This data is from a J-PAL study in India that evaluated the effect of having extra tutors (*balsakhis*) in schools on students' test scores. 122 schools were identified to be in the evaluation sample. A baseline survey collected data on the language, area, and pre-study average test score (`pretest_mean`). After conducting the baseline survey, we need to assign schools to the treatment and control groups.

a. Simple randomization

- In order to be able to replicate the random assignment¹, we start with sorting by a unique ID (in this case, `schoolid`) and then the `"set seed"` command
- We generate a random number between 0 and 1 by using the `"uniform()"` command, and then we sort the data on this random number
- We have a randomly sorted dataset and assign the first (or second) half of the observations to the treatment group by creating a new dummy variable and assign it the value 1

b. Stratified randomization on discrete variable

- The goal is to have a random assignment stratified by language, i.e. control and treatment will be balanced along this variable
- We drop the previously created treatment dummy and random number variable
- We create a new random variable
- We sort first by `language` and then by the random variable – browse the data set to see how observations within a given language are grouped in random order: e.g. there are 10 Hindi speakers
- Similar to previous procedure, we assign the first half of observations within each group to the treatment group. To do so, we first need to know how many variables are in each group (use `"by language: create VARname = _N"`)
- In theory, we can stratify along more variables, e.g. language, gender and area, following the same procedure

¹ Replication is important for various reasons. For one, we want to be able to retrospectively check our own work. Also researchers increasingly publish both data set and do-files online. Lastly, peer review journals often ask for the original dataset and statistical analysis code.



c. ADVANCED: Stratified randomization on a continuous variable

- Often studies stratify on the pre-treatment outcome variable (Why?). In our case this would be `pretest_mean`
- In this exercise we stratify along `language` and `pretest_mean`
- We start with our original dataset (drop variables created before)
- We set the seed and generate a random number (in the do file this is referred to as `random`)
- We sort by `language` and `pretest_mean`
- We determine size of each language group
- Within each language we split schools into groups of 2 using the command `"gen group = group (size_var/2)"`
- Within each group/pair we randomly sort, i.e. sort by the variables `language`, `group` and `random`
- Within each group we assign the order using the `"_n"` command and assign all observations with `"_n==1"` to treatment group

d. Balance Test

- If you were not able to complete previous exercise (1.c), open dataset `TTEST`
- The goal is to check if the control and treatment groups are indeed statistically identical – we test it on the variables for `language` and `pretest score`
- We first need to convert the `language` string variable into a numeric variable using `"egen NAME = group(language)"`
- We conduct a t-test for both `language` and `pretest score` to see if the difference in means is statistically significant (`"ttest VARNAME, by(treatment)"`)
- We then compare distributions of `pretest scores`
 - Create `kdensity` graphs for the control and treatment group (`kdensity pretest_mean`)
 - Run a Kolmogorov-Smirnov test for equality of distribution of treatment and control `pretest scores` (`ksmirnov ... , by...`)
- How do you interpret the results? Was randomization successful?



2) Power Calculation (40min)

Study Background: Imagine you plan a study on the effect of new math text books. We have not decided whether to do an individual or cluster randomization design and will conduct power calculations for both.

Recap: The following parameters are needed in the power calculation:

Individual Level Randomization

- N = number of individuals
- R-squared = the proportion of variation in outcome that can be explained through covariates
- Alpha (level of significance)
- P = Power
- Delta = MDES or Effect size (measured in standard deviations). For example, we want to be able to detect an average math score increase of 30% (20 to 26), and the standard deviation is 40 → MDES = $(26-20)/40 = 0.15$ standard deviations

Cluster level randomization: alpha, power and r-squared as above plus:

- n = cluster size (e.g. number of students per school)
- J = number of clusters
- ρ = Rho - intra-class correlation (% of outcome variation explained by cluster)

2.1 Estimating Parameters

We need to specify alpha, as well as the power and the cluster size. The biggest challenge is estimating **R-squared** and **rho**. We know of a similar study that looked at the effect of tutoring on test scores. We can use the data from that study on pre- and post-test scores for students in our sample and can estimate how much variation in post-test scores can be explained by pre-intervention test scores and the school.

- a. Open the data set “2_power_calc_similarData.dta”
- b. Estimate how much of the variation in test score can be explained by the variables `pre_score` and `schoolid` (regress the post scores on these covariates and record r-squared). This may be a good estimate for **R-squared** in our individual (and cluster) level randomization.
- c. Estimate the intra-class correlation of our cluster variable (`schoolid`) using the “`lonevar outcomevarNAME clustervarNAME`” command. This gives us the rho for this data set. This may be a good estimate for intra-cluster correlation of schools (**rho**) in our cluster since we have also used schools as a unit of randomization and looked at the same outcome measure (math scores).



2.2 Calculating sample size


We can use Optimal Design and STATA to estimate a sample size necessary to detect a certain effect size.

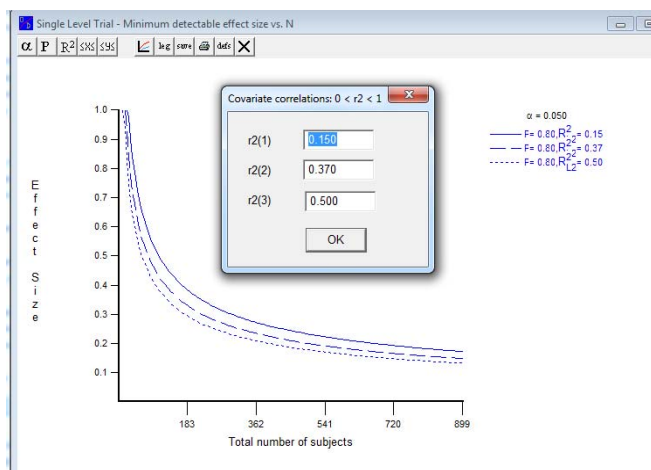
Optimal Design

(i) **Individual level randomization:** We have the following estimates: $\rho=0.2$, $R^2=0.37$ and we use conventional values for $\alpha = 0.05$ and $\text{power} = 0.8$.

Since we have estimates for three of the estimates (power, alpha, r-square), we start by depicting the relationship between the effect size (MDES) and sample size (n).

In Optimal Design select the following tabs: Design > Person Randomized Trial > Single Level Trial > MDES vs n.

- i. We enter values for alpha, power and r-square
- ii. How many subjects do we need to detect an effect size of 0.25? you need to extend x-axis using the button: 
- iii. We are not as confident in our r-square estimate and want to test its sensitivity on sample size by entering different values in the 2nd and 3rd square field (see graph). If the power is very sensitive to r-squared then we may want to get a more reliable estimate of it.



(ii) Cluster level randomization:

Since we now have estimates for four of the parameters (power, alpha, r-square, rho) and have some freedom to decide on n (students per school), we start by depicting the relationship between the effect size (MDES) and number of clusters (J)

In Optimal Design select the following tabs: Design > Cluster Randomized Trial with personal level outcomes > Cluster randomized Trial > Treatment at Level 2 > Single Level Trial > MDES vs n

- i. We enter values for alpha, power, r-squared and rho
- ii. We are not sure whether to include 20 or 40 students per school (n=cluster size)
- iii. For n=20 (40), how many clusters do we need to detect an effect (MDES) of 0.3?
- iv. Let's test how much our power calculation depends on our estimate of rho



- v. We have the choice of increasing the number of clusters OR the cluster size. How does the optimal decision depend on the intra-class correlation (ρ)?

STATA

Optimal Design is a good starting point for power calculation. However, doing power calculations in STATA has several advantages: power calculations are easier to reproduce using many different assumptions, and easier to log and export into a spreadsheet. In addition, STATA offers some options for power calculations that Optimal Design doesn't provide.

Sampsi command:

- i. Syntax: `sampsi #1 #2 [, options]`
 - o #1 and #2 refer to outcome means of treatment and control group; we typically enter sizes measured in standard deviations (e.g. "`sampsi 0 0.2, sd(1)`" means showing effect of 0.2 s.d.)
 - o See list of options from STATA comment below

```
[R] sampsi — Sample size and power determination
```

Syntax

```
sampsi #1 #2 [, options]
```

options	description
Main	
onesample	one-sample test; default is two-sample
sd1(#)	standard deviation of sample 1
sd2(#)	standard deviation of sample 2
Options	
alpha(#)	significance level of test; default is alpha(0.05)
power(#)	power of test; default is power(0.90)
n1(#)	size of sample 1
n2(#)	size of sample 2
ratio(#)	ratio of sample sizes; default is ratio(1)
pre(#)	number of baseline measurements; default is pre(0)
post(#)	number of follow-up measurements; default is post(1)
nocontinuity	do not use continuity correction for two-sample test on proportions
r0(#)	correlation between baseline measurements; default is r0(=r1(0))
r1(#)	correlation between follow-up measurements
r01(#)	correlation between baseline and follow-up measurements
onesided	one-sided test; default is two-sided
method(method)	analysis method where <i>method</i> is post , change , ancova , or all ; default is method(all)

- ii. Individual level randomization: alpha=5%, power=80%, MDES=0.25
`sampsi 0 0.25, sd(1) power (0.8)`
- iii. We can now look into additional features
 - o Sometimes, it makes sense to have more than 50% of the sample in the control group (if e.g. the treatment is very expensive). Look at the effect on sample size if we have 66% of sample in the control group (`ratio` option)
`sampsi 0 0.25, sd(1) power (0.8) ratio (2)`
 - o How does the required sample size change for a **one-sided** test?
`sampsi 0 0.25, sd(1) power (0.8) onesided`
- iv. Cluster design estimation: alpha=5%, power=80%, MDES=0.25, rho=0.1, cluster size=35



- We use the `sampclus` command, but first need to download it through `findit sampclus`
- `Sampclus` needs to be preceded by the `sampsi` command
`sampsi sampsi 0 0.25, sd(1) power (0.8)`
`sampclus, obsclus(35) rho(0.1)`

2.3 Computing MDES for given sample size

If our maximum sample size is externally given (due to budget constraints or small population) we can compute the minimum effect size (MDES) that we could detect with the given statistical power.

- a. Due to budget constraints we only have two design options: (i) an individual level randomization with 1100 students or (ii) a cluster level randomization with 70 classes, each of which has 20 students. We don't have covariate data (i.e. $r\text{-squared}=0$), $\rho=0.05$, $\text{power}=0.8$, $\alpha=0.05$
- b. Which of the two options do you prefer? You can use STATA (if you have downloaded the `sampclus` command) or Optimal Design.
- c. The minister of education states that he would only implement the program if the study can show an effect size of 0.15 standard deviations. Should we embark on this study?

Key vocabulary

1. **Power:** the likelihood that, when the program has an effect, one will be able to distinguish the effect from zero given the sample size.
2. **Significance:** the likelihood that the measured effect did not occur by chance. Statistical tests are performed to determine whether one group (e.g. the experimental group) is different from another group (e.g. comparison group) on the measurable outcome variables used in the evaluation.
3. **Standard Deviation:** a standardized measure of the variation of a sample population from its mean on a given characteristic/outcome. Mathematically, the square root of the variance.
4. **Standardized Effect Size:** a standardized measure of the [expected] magnitude of the effect of a program.
5. **Cluster:** the level of observation at which a sample size is measured. Generally, observations which are highly correlated with each other should be clustered and the sample size should be measured at this clustered level.
6. **Intra-cluster Correlation Coefficient:** a measure of the correlation between observations within a cluster; i.e. the level of correlation in drinking water source for individuals in the household.



Transportation

Taxis:

Standard rates are R 10 per km. If you need a receipt, please tell the cab driver before getting into the car. Local cab companies include:

Cabs on Call: 021 5226 103

Cab Xpress: 021 448 1616

Excite Meter Cab: 021 418 444

Transport from Ritz Hotel

The hotel can arrange the hotel shuttle to bring you to and from UCT in Rondebosch. The rates for this transport will be R100.00 per trip, if the shuttle is taking 5 or less people. For more than 5 people per trip they will charge a “per person” rate of R20.00 per person per trip.



Practical Tips

Shopping

On campus: There are cafeterias near the centre of Upper Campus selling a range of food products, from sandwiches to sushi.

Off campus:

Southern Suburbs (if your hotel is in Rondebosch or Claremont)

Cavendish Square is located just off Claremont Main Road and is bound to satisfy all your shopping desires. If one is looking to do a little grocery shopping, the Woolworths food is located on the bottom floor. Alternatively, if you wish to avoid the rush of the mall, you can find a Pick n' Pay supermarket a little further down Main Road towards Rondebosch. A smaller Pick n' Pay and Woolworths food are also situated closer to the university on Rondebosch Main Road and are a 15 minute walk from UCT.

Cavendish Square

Open times: 09:00-19:00 (Mon-Sat), 10:00-17:00 (Sundays)

Address: Dreyer Street, Claremont

Website: www.cavendish.co.za

Call: 021 657 5620

Pick n' Pay (Claremont)

Open times: 08:00 – 19:00 (Mon-Sat), 08:00- 17:00 (Sun)

Address: Corner Campground & Main Road, Claremont

Call: 021 674 5908

Pick n' Pay (Rondebosch)

Open times: 08:00-22:00 (Mon-Sun)

Address: Shop No 1, Village Centre, Main Road, Rondebosch

Call: 021 685 4001

Woolworths (Rondebosch)

Open times: 09:00-21:00 (Mon-Fri), 09:00-20:00 (Sat-Sun)

Call: 021 685 4416

Other large malls in Cape Town:

The Waterfront (for when you are closer to town or visiting Robben Island)

Website: www.waterfront.co.za

Call: 021 408 7600

Century City (for when you want to visit the biggest mall in Africa)

Website: www.centurycity.co.za

Call: 021 552 6889

Alternative places to buy groceries and snacks:

Many of the petrol stations around Cape Town have little food stores.



Restaurants

Cape Town is known for its diverse array of dining and cuisine. Here is but a small list of well-known restaurants that you may wish to try.

* These restaurants are fairly close to the Vineyard Hotel, Southern Sun, Graca Machel and the All Africa Hotel.

Budget (Main meal under R50)

1) Eastern Food Bazaar

Cuisine: Indian, Chinese
Location: City Bowl
Contact: 021 461 2458

2) Mzolis

Cuisine: African, BBQ
Location: Gugulethu
Contact: 021 638 1355

***You will need a guide or someone
from Cape Town who knows the
area!***

3) *Food Lovers Market

Cuisine: Deli, Buffet – Basically
everything
Location: Claremont
Contact: 021 674 7836

Medium price range (Main meal between R50 and R100)

1) *Col Cacchio Pizzeria

Cuisine: Pizza
Location: Claremont (Cavendish),
Camps Bay
Contact: 021 674 6387/ 021 438
2171

2) *Kirstenbosch Tea Room

Cuisine: Coffee Shop
Location: Kirstenbosch Gardens,
Newlands (Not for dinner)
Contact: 021 797 4083

3) *Rhodes Memorial Restaurant

Cuisine: Bistro, Coffee Shop
Location: Rhodes Memorial
Restaurant (Not for dinner)
Contact: 021 687 0000

4) *Fadela Williams

Cuisine: Cape Malay
Location: Claremont
Contact: 021 671 0037

5) *Hussar Grill

Cuisine: Grills
Location: Rondebosch
Contact: 021 689 9516

6) Addis in Cape

Cuisine: Ethiopian
Location: City Bowl
Contact: 021 424 5722



***Higher End
(Main meal - R100 and above)***

- | | |
|--|---|
| 1) *Die Wijnhuis
Cuisine: Mediterranean, Italian
Location: Newlands
Contact: 021 671 9705 | 4) Olympia Cafe
Cuisine: Deli, Bakery, Coffee Shop
Location: Kalk Bay
Contact: 021 788 6396 |
| 2) *Barristers Grill
Cuisine: Grill and Seafood
Location: Newlands
Contact: 021 671 7907 | 5) *Bihari
Cuisine: Indian
Location: Newlands
Contact: 021 674 7186 |
| 3) Panama Jack's Taverna
Cuisine: Seafood
Location: Table Bay harbour
<i>Lunch rates are lower. For example they offer a half-kilo of prawns for only R60 during the week</i>
Contact: 021 448 1080 | 6) Jonkershuis Constantia Eatery
Cuisine: Bistro
Location: Constantia
Contact: 021 794 4813 |
| | 7) Moyo
Cuisine: African
Location: Stellenbosch
Contact: 021 809 1133 |

Internet Access

Most hotels will have access otherwise ask for directions to your nearest internet café.

Electricity

Voltage: 220/230 V

Adapter: You will need an adaptor for Plug M and sometimes plug C. Plug C is the two-pin plug commonly used in Europe.

Money

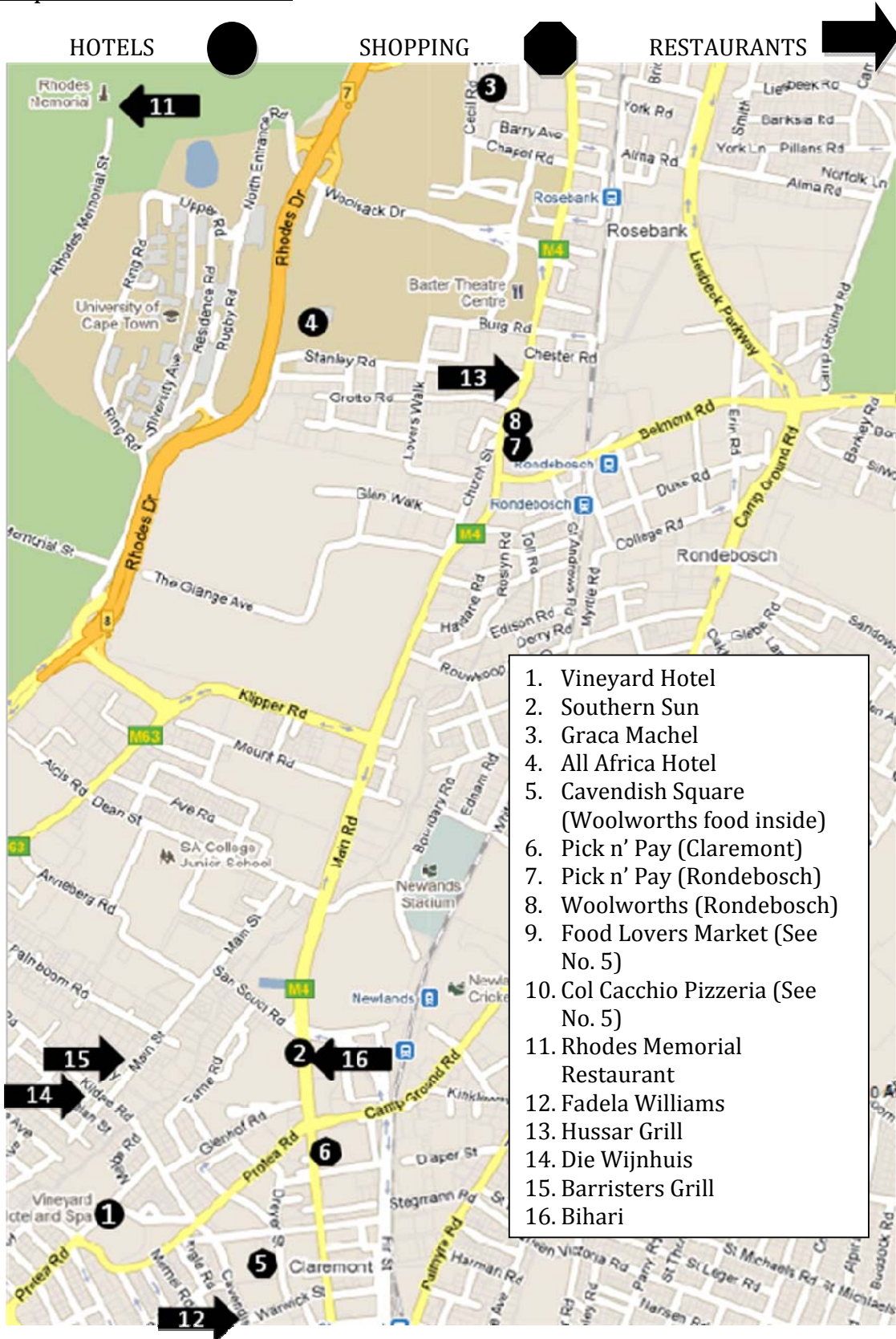
Withdrawals: We suggest that you use the campus ATM machines. They are situated on Middle Campus (next to the cafeteria), and Upper Campus (ground floor of the Leslie Social Science building and next to the library).

Credit Cards: When paying by credit card, we suggest that you ask vendors to swipe the card in your presence.

Exchange Rate: The current exchange rate is 6.81 South Africa Rand to the US-Dollar.



Map – Southern Suburbs





Things to Do in Cape Town

NUMBER 1: Robben Island

Price: adult (R200); children under 18 (R100)

The standard tour to Robben Island is 3.5 hours long, including the two half-hour ferry rides. Ferries depart at **9am, 11am, 1pm and 3pm** everyday (weather permitting) from the V & A Waterfront in Cape Town. The summer season is very busy and we recommend you **book early to avoid disappointment!** Booking a minimum of three days in advance is recommended.



To book tickets:

Website: www.robben-island.org.za

Call: 021 413 4220/1 (Robben Island Museum); 021 413 4233 / 37 (Advanced Booking)

Email: rimbookings@robben-island.org.za

The ticket sales office is located at the Nelson Mandela Gateway at the V&A Waterfront, Cape Town.

Once you have completed your trip, you may wish to indulge in a bit of shopping or have a relaxing lunch at one of the many restaurants situated at the Waterfront on the harbour.

NUMBER 2: Table Mountain

Price: Cable car (Return and one way tickets available)

Adult: Return: R180 (Office rate); R170 (Online rate)

Children (4 – 17 years): Return: R90 (Office rate); R80 (Online Rate)

Children (Under 4): Free

Sunset special: For the month of January, return tickets after 18h00 will be half price and can be bought only from the ticket office at the Lower Cable Station after 18h00.

One can either cable car or walk up to reach the top of the mountain. The cable car goes up every 15 minutes, so you don't need to worry about catching one. However you will need to take note of the weather. Trips do not take place when the weather is poor. You can check whether the cable car is active by calling the information hotline or checking their website below.



Opening hours for cable car (every day in January)

First car up: 08:00

Last car up: 20:30

Last car down: 21:30



To buy tickets

Website: http://tablemountain.net/buy_tickets/

Ticket sales are available at the ticket office

Alternatively one could walk to the top, for example from Kirstenbosch Gardens or Camps Bay. See <http://www.tablemountainwalks.co.za> for more information. These are strenuous walks and require plenty of water and proper footwear.

For more information:

021 424 8181

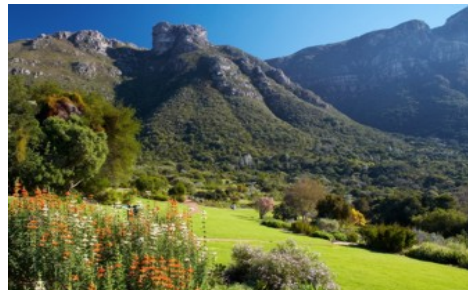
NUMBER 3: Kirstenbosch Gardens

Entrance Fees (bought at the office):

Adults: R37

Children (6-17yrs): R10

Under 6 yrs: Free



Kirstenbosch National Botanical Garden is acclaimed as one of the great botanic gardens of the world. There are over 7 000 species in cultivation at Kirstenbosch, including many rare and threatened species.

Operational hours in Summer: Monday – Sunday (08:00 – 19:00)

Physical Address: Rhodes Drive, Newlands, Cape Town, South Africa

For more Information

Call: 021 799 8783

Website: www.sanbi.org

Restaurant: Silver Tree (021 762 9585); The Kirstenbosch Tea Room (021 797 4883)

During summer, Kirstenbosch holds weekly summer sunset concerts featuring some of the top musicians in SA. Tickets can be booked online at <http://www.uncoverthecape.co.za/event-calendar/kirstenbosch-concerts.htm>, by telephone (021 761 2866), or at the Kirstenbosch ticket office. Early booking is a must. Tickets range between R75 and R120 for adults.

NUMBER 4: Boulders, Cape Point, Chapman's Peak Drive

This driving tour visits a few scenic view points. We recommend taking a road map. The trip will take you from Cape Town to Cape Point and back. The stop-offs that we suggest:

1. Boulders





Just around the corner from the seaside village of Simons Town turn left off main road to Boulders Visitor Centre to visit the famous colony of Jackass Penguins, so called for their hilarious braying call.

Opening times: 08:00-17:00

2. Cape Point



Prices:

Cape of Good Hope Entry: R80 (Adult); R20 (Scholar)

Flying Dutchman Funicular: R45 (Adult return); R35 (Adult single); R20 (Scholar return); R15 (Scholar single)

Cape Point, the south-western most tip of Africa, is recognised globally for its extraordinarily rich, diverse and unique fauna and flora – with rugged cliffs, steep slopes and sandy flats. For an extra fee, the

Flying Dutchman Funicular lifts you 238 metres above the ocean, to the lighthouse; the ride offers panoramic views.

Opening times

Cape of Good Hope: 06:00 – 18:00

Flying Dutchman Funicular: 9:00 – 17:30

For more information

Visitor Centre: 021 780 9010

Email: info@capepoint.co.za

Website: www.capepoint.co.za

Two Oceans Restaurant: 021 780 9200



3. Chapman's Peak Drive

Chapman's Peak Drive winds its way between Noordhoek and Hout Bay for 9km. The drive offers stunning 180° views with many areas along the route where you can stop and take in the scenery or sit down for a relaxing picnic.

Toll Tariffs (Operates 24 hours)

Motor Cycle: R19.00 one way

Light Motor Vehicle: R30.00 one way

Minibus: R40.00 one way

4. Other stops along the way

Muizenberg beach, Kalk Bay, Fish Hoek Beach, Simons Town and Hout Bay.



NUMBER 5: The South African National Gallery

If you would like to take a peek at some South African heritage, why not head down to the South African National Gallery situated in the Cape Town Company's Garden near Parliament.

Opening times: 10:00-17:00 (Tuesday to Sunday)

For more information: 021 467 4660

Entrance fees

Adult: R15

Under 16 years: free



"Butcher Boys" by Jane Alexander

For more information on the variety of museums in Cape Town, go to www.iziko.org.za.

NUMBER 6: Atlantic Seaboard Beaches



Beaches of the Atlantic Seaboard are comprised of Clifton, Camps Bay and Llandudno. Although the water on this side is chilly, on a hot summer day a swim can be rather refreshing. These are generally the more 'trendy' beaches where many locals spend their weekends.

Clifton Beach is made up of 4 coves and the beaches are called 1st, 2nd, 3rd and 4th.

When the summer south-easter blows, the Clifton beaches are usually well sheltered from the wind. All of the beaches are accessible via stairs leading down from the road above. In summer, plan to get to the beach early as parking is very limited. Kiosks on the beach sell snacks, cold drinks and ice-creams as do the many vendors that wander the beach. Deck chairs and umbrellas are also available for daily rental.

Camps Bay is a long sandy beach accessed directly from the road. Again, parking in summer is limited and you may need to park along one of the many side-roads. The road behind the beach is lined with street-side cafes, restaurants and a few small grocery stores making snacks and lunch easily at hand.

Llandudno Beach is by far one of the most beautiful beaches and a favourite for sundowners. This beach is slightly more remote with no shops and sadly poor bathroom facilities, but vendors do operate on the beach for snacks, drinks and ice-creams. Deck chairs and umbrellas are available for daily rental.



NUMBER 7: Lion's head

Starting and ending point: Signal Hill Road, at the Base of the Forestry Road

Walk duration: 2 ½ - 3 hours (Add on for stops)

Type of Terrain: Gravel road, Rocky single track, Steep section with chains to pull yourself up, Ladders.

Difficulty: The majority of the walk is steep but easy going. The last section is very steep and you need to use chains to climb up a section of boulders, which increases the difficulty of this walk. Please carry plenty of water.



NUMBER 9: Stellenbosch wine route



The Western Cape is well known for its wine routes, but the oldest and largest in South Africa is the popular Stellenbosch route. Situated just outside of Cape Town, the route boasts over 140 farms. Everyone has their favourite farm, so take a look at www.wineroute.co.za for some options. Most farms provide tasting facilities for a small fee, while some serve lunch. Don't forget to reserve a table!

DAY TOURS AND GUIDES

- 1) **African Eagle** provides full-day guided tours to a number of destinations in the Cape Town area, including wine routes, Cape Point and Kirstenbosch. For more information see their website www.daytours.co.za.
- 2) **Andulela** offers both standard tours of the Cape plus some alternative offers such as bo kaap cooking, jazz outings, and safari outings. For more information see www.andulela.com.
- 3) **Vamos** offers township tours by bike and on foot. For more information see www.vamos.co.za. To book call Garth at 083 452 1112 or email info@footstepstofreedom.co.za.
- 4) **AWOL Tours** is situated in the Waterfront next to Ferrymans Tavern and provides single-speed or geared bikes for rent. You can use the bikes to tour Cape Town yourself or take part in a guided tour of the waterfront, Cape Town stadium, among others. They also do Cape Peninsula bike tours, hiking and the Masiphumelele bicycle tour. For more information see www.awoltours.co.za.
- 5) **Ridgway Ramblers** offers excellent hiking guides. For more information contact www.ridgwayramblers.co.za.



TRANSIT INFORMATION (if you do not have access to a car)

Public transport

Website: <http://www.capetown.gov.za/en/transport/Pages/default.aspx>

Call: 0800 65 64 63 (toll free)

E-mail: transport.info@capetown.gov.za

Taxi services

Town:

Rikkis Taxis: 086 175 5547

Excite Taxis: 021 448 4444

Alternatively ask your hotel



City Sightseeing Bus

If you have limited time in Cape Town, but would like to see as much as possible – this is the option for you! You can purchase a one-day ticket and hop onto the Red City Tour, which will take you to Table Mountain Aerial Cableway, the V&A Waterfront, Camps Bay and around the city centre of Cape Town – there are a total of 17 stops on this tour. Adults pay R110 if purchased online (www.citysightseeing.co.za) or R120 if bought in person (tickets are valid only on the day of purchase). See website for more details.



Health and Emergencies

On campus:

- 1) Campus Protection Services: 021 650 2222/3
- 2) UCT Emergency Controller: 021 650 2175/6

Off Campus

- 1) Kingsbury Hospital (Wilderness Road, Claremont): 021 670 4000
- 2) Constantiaberg Medi-Clinic Hospital (Burnham Road, Plumsted): 021 799 2911 / 021 799 2196 (Emergency number)
- 3) Kenilworth Medicross (67 Rosmead Avenue, Kenilworth): 021 670 7640 – for doctor's visits

State Emergency Number (Police and Ambulance Services): **10111**

Private Ambulance Services: Netcare911: **082 911**

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