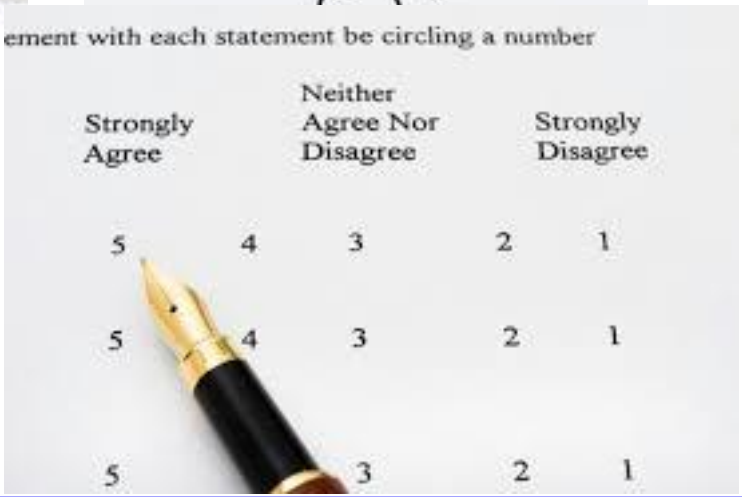
MIOT H6023 Research Project (Part 1: Research Methods)

Survey Research Methods



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FUNDAMENTALS OF SURVEY RESEARCH

Research only has value when outcomes can directly or indirectly be used to improve/enhance of human life.

- **Surveys are used to seek information about &/or feedback from people about the outcomes/proposed outcomes of research— this could be a research in product or service.**
- **Alternatively, assessment of usability of a product or service can be the subject of a research programme, requiring a structured survey of the potential users of product.**

Failure to *consult* the potential users/stakeholders of new product/equipment, system, process, & particularly developing technology may restrict applications or render it unusable. For example, the Dept of Engineering at ITB has been developing a Learn + Work Programme *BSc in Process Instrumentation & Automation* (PI&A)— a key requirement has been to consult companies that employ PI&A Technicians & Technologists, to solicit their view on the proposed curriculum model, its contents (*vis-à-vis* role competencies), the enrolment criteria, & the funding model.

You will note that, *Stakeholder Consultation & Surveys* are key parts of new course development & QA process. Please refer to the sample consultation documents on Lecture 6 Resources folder; *Learn + Work Eng Event (Abstract), &; Learn + Work Eng Event Consultation Forum (Version 2)*.

- **Design challenge in embedding safety in equipment &/or process, accounts for whether the device is used by the intended users, & also, unintended users should not face accidental exposure.**

Consideration 1: Disability Challenge (see Universal Design illustration on the next slide)

- **Is it possible to design doors that are convenient for wheelchair users?**
- **How is it possible to implement a fire alarm system for a profoundly deaf person?**
- **Is the R-A-G traffic light colour scheme suitable for the 10% of male population with red-green colour blindness?**

Creative designs are required to address the above; and, the ability of the intended population to use them MUST be reviewed through surveys

Consideration 2: Dangerous Goods Challenge

- **Product standards require that: children's toys must not be coated with lead-based paints; must not have sharp edges or small parts that can be swallowed; etc.**
- **Mineral mining can cause dust hazards, ground subsidence & pollution in streams & other waterways.**

A survey could be used to establish the effectiveness of production & sale controls of such products & services, and the survey results may lead to restriction of use & access.

Universal design

Difficulty Level ★☆☆☆☆
☐ Grammar ☑ Vocabulary

Universal design is a process of creating products, environments and systems which are __(1)__ by people with the widest possible range of __(2)__.

(1)	A. usable	B. used
(2)	A. possibilities	B. abilities

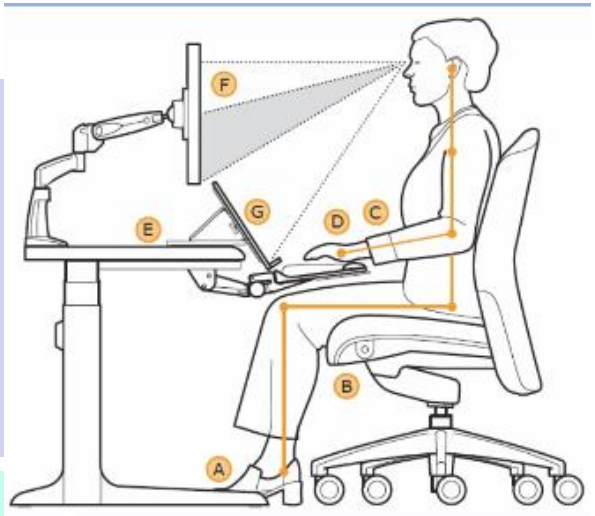
Reference: http://trace.wisc.edu/docs/whats_ud/whats_ud.htm

(1) A (2) B

FUNDAMENTALS OF SURVEY RESEARCH

- **The desired information to meet the outlined challenges can only be obtained in a rational controlled manner & from a representative sample population through the use of a *Well-constructed, Scientifically Based Survey*.**

- **Two distinct investigations that require collation of feedback from user groups or the general population—i.e., the bases of surveys, are:**



(a) Characteristics of human subjects

- **Physical, mechanical. Chemical, genetics, & physiological parameters including impairments;**
- **These are described in terms of anthropometric (see adjacent figure), biomechanical, & biochemical processes**
- **Requires measurement of physical & chemical parameters.**

(b) Public opinion

- **What they think about objects/products & systems.**
- **Commonly described in terms of social, cultural, religious, political etc., aspects of human life—these refer to *Usability Surveys***
- **Response based on opinion can be time dependent & may be influenced externally (*viz.* media, & associates such as friends, neighbors, etc.**

FUNDAMENTALS OF SURVEY RESEARCH

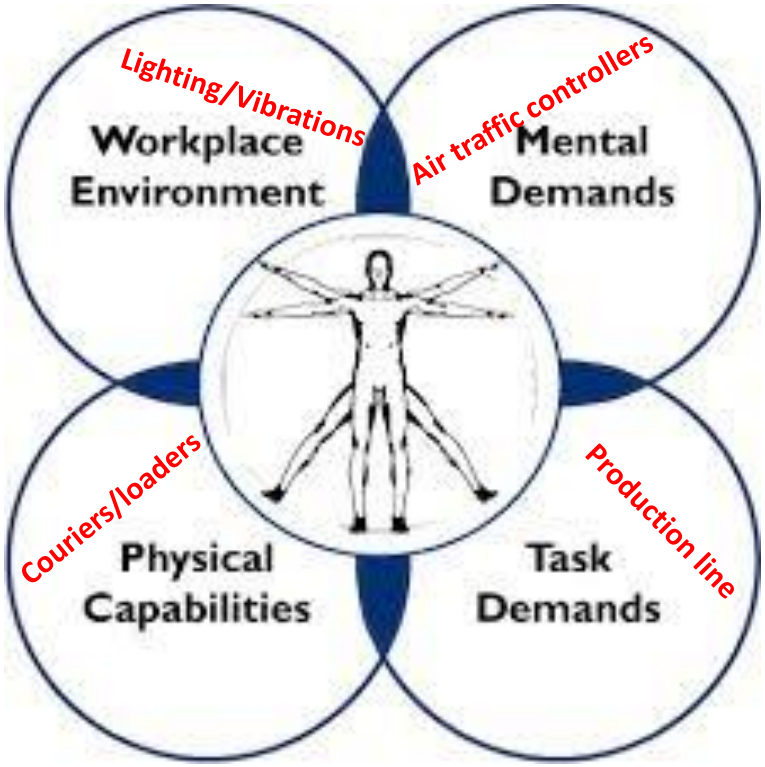
Most surveys will have the following requirements:

- **Sample size— Population must be sufficiently large to allow for statistical analysis & inferences;**
- **Time constrained— Survey time to be relatively short to ensure that recent events do not impact on the surveys outcomes [consider opinion surveys in changing political circumstances].**
- **Anonymity— The population should be sufficiently large to ensure that individual identities cannot be inferred from the statistical data;**
- **Unbiased— The population must be sufficiently diverse to ensure that population groupings are not subject to adverse stereotyping;**
- **Voluntary— participation with no mandatory requirement for completion of all questions/sections.**
- **The survey result be presented to the population surveyed in an understandable form.**

HUMAN FACTORS RESEARCH.....(ERGONOMICS)

- **Human Factors Research**— refers to the field of research into the use of technology by humans (*viz.*, handling of tools, comfortable reach in work zones etc.).

- **Ergonomics**— refers to scientific discipline concerned with interactions between humans & functional elements of a system. It applies applies theory, principles, data, & research methods to design, in order to optimize human well-being &/or overall system performance. Ergonomics requires definition of the normal range of human functions in form of Anthropometric measurements.



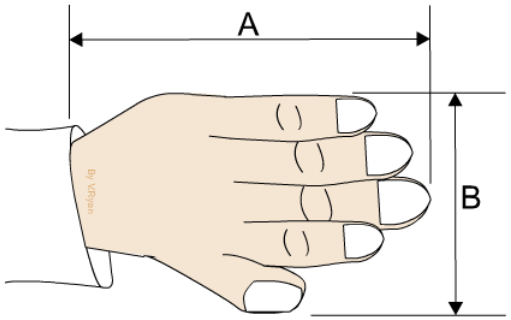
- Office chairs should comfortably seat the shortest & the tallest individuals in the population for an 8 hour work period.
- Car seats must suit a wide range of adults.

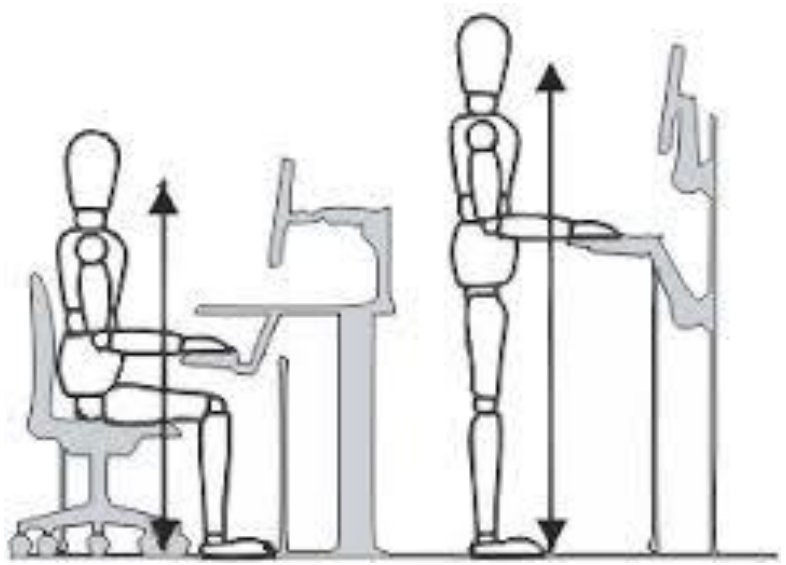
- **Anthropometric measurements— are systematic measurements of the size, shape & composition of the human body.**
- **Measurements are useful in Industrial/Engineering Design, Clothing Design, Architecture etc.; detailed lists exists of proportions of limb segment lengths with respect to total heights, etc.**
- **Some examples are such as illustrated below.**

ANTHROPOMETRIC DATA

PUPIL/PERSON	A	B
Child A	100mm	53mm
Child B	103mm	45mm
Child C	90mm	47mm
Child D	95mm	44mm
Child E	102mm	50mm
Child F	87mm	41mm
Child G	75mm	43mm
Child H	102mm	51mm
Child I	104mm	51mm
Child J	74mm	36mm
Child K	78mm	46mm
Child L	81mm	39mm
TOTAL(S)	1091mm	546mm
AVERAGE	90.8mm	45.5mm

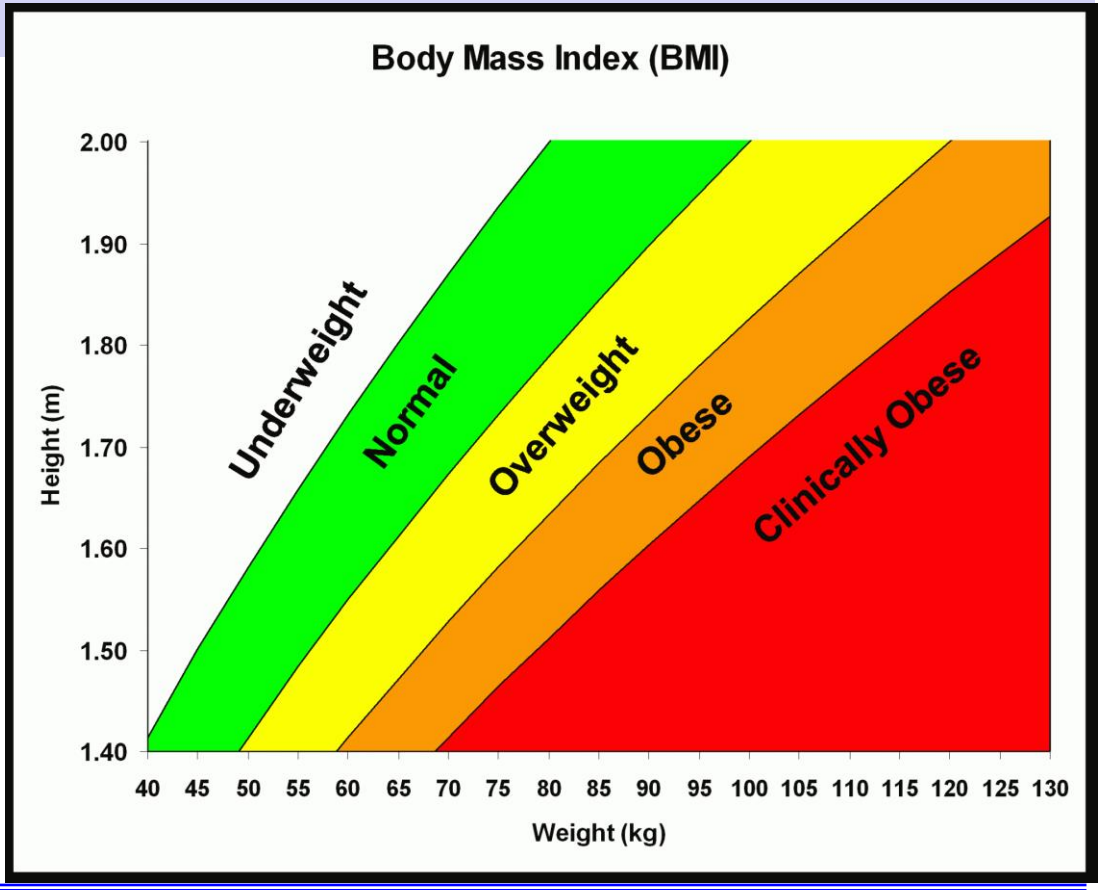
DATA APPLIED TO THE HAND - ERGONOMICS





- Measurements are also useful in healthcare for which body measurements may be used to evaluate a patient's overall state of health. For example, Body Mass Index (BMI) is a measurement of a person's weight-to-height ratio. Healthcare providers, insurance companies, etc., may use BMI to determine if a person is underweight, overweight or obese.

- A BMI (weight in kg/(height, m)^2) ≥ 30 indicates obesity & because obesity is linked to chronic diseases (e.g., heart disease, diabetes, certain cancers), knowing BMI as an anthropometric measurement can be a lifesaver.



HUMAN FACTORS RESEARCH…….(ERGONOMICS)

Definition of such ergonomics & human factors require feedback from the population/population samples.

The process for human factors research mainly follows the following structure:

- **Affirm research question;**
- **Develop research plan;**
- **Design of survey instrument;**
- **Apply for ethics approval;**
- **Make contact with the sample population;**
- **Administer questionnaire (from researcher directly or via an agent);**
- **Prompt sample population for response**
- **Analyse data**
- **Generate conclusions & report.**

ETHICS REVISITED ..... REQUIREMENT FOR ETHICS APPROVAL

- **A survey must eliminate bias & also enable/maintain *Confidentiality*.**
- **To forestall any bias (pre-determined response out of fear by respondents, e.g., students commenting on lecturers' teaching), many surveys are commissioned to be carried out by independent agents (*viz.* ipsos MRBI, amarach research etc.).**
- **Since surveys involve seeking opinions or personal details of respondents,** *Ethics Approval* **to conduct the research is mandatory.**

[Important: some academic journals will not publish survey results unless accompanied by approval from a certified ethics committee]

- **Application for ethics approval will generally require:**

(a) Information sheet—outlining projects aims, methods, requirements of participants, & names + researchers' contact details (see illustration of *Sample Survey Information Sheet* in Lecture 6 Resources folder);

(b) Informed Consent Form (each participant is assigned an ID #)–- participants acknowledge that they are adequately informed about the research, & sign & date form.

(c) Survey sheet--- completed by the respondent (but only the participant ID # is on sheet, & allows the information to be stored separately from the consent form)

ETHICS REVISITED ..... REQUIREMENT FOR ETHICS APPROVAL

Recall the following Case Study 2 from Lecture 2 Resources; UKRIO. 2017. Case studies for discussion; Research Integrity Peer-Learning Event, Irish Universities Association February 2017.

There are concerns about the research of M, a PhD student in the School of Social Sciences. A significant part of M's research involved interviewing a number of vulnerable adults about their experiences with the UK social care system. The interviews involved discussion of the reasons why the participants required assistance from the social care system & the nature & outcome of that assistance. The PhD project has been written up & M is about to sit her viva.

M identified potential interviewees according to the approved research design, provided them with information on the study & sought their consent to participate. All of the actual interviewees gave their consent to participate & did so in writing. However, it has since been discovered that:

- The study used a significantly modified consent form rather than that originally approved by the Ethics Committee. This meant that participants gave permission for their data to be used for purposes which the Ethics Committee had not approved.
- Some of the questions asked in the interviews were significantly different from those originally approved by the Ethics Committee.

The changes that have been made to the consent form & the interview questions are substantial, rather than minor or trivial – both documents have been significantly altered. The changes go far beyond any reasonable alterations to the wording, such as from proof-reading or other editing after ethical approval had been received.

The university has only begun to look into the matter properly. However, M has already said that her PhD supervisor within the university had confirmed that ethical approval had been given for the project & that the instructions of the Ethics Committee were being followed – i.e. that M was doing nothing wrong. As a PhD student, M had felt it was reasonable to take on trust the information she received from her supervisor.

- What should be done in response to the concerns about M's research?
- Should M be allowed to sit her viva or not? Might there be an alternative solution?
- Are there any wider issues to consider?

SURVEY GUIDELINES

- There are strategic approaches to conducting surveys, with compatible semi-automated survey tools available on the web, e.g., Google Survey Tool, Survey Monkey, etc.

- Rather than asking questions, surveys should seek respondent reaction to carefully worded phrases/sentences

- Sections in the survey instrument will include:

  Section 1- Introduction;

  Section 2- Instructions on how to complete survey (respondents may decide to leave blanks on paper based surveys, but online surveys can be constrained to prevent progression until all sections are completed);

  Section 3- survey statements;

  Section 4- demographics of respondents;

  Section 5- open ended/free-text questions.

SURVEY GUIDELINES

Survey title

Introduction (Outline the reasons for the survey, the survey team, the ethics approval number, research team contact details, time lines etc)

Instructions: Circle/highlight one response to each of the following statements

Survey Statements

	Strongly disagree				Strongly agree
Statement 1	1	2	3	4	5
Statement 2	1	2	3	4	5
Statement 3	1	2	3	4	5
Statement 4	1	2	3	4	5
Statement 5	1	2	3	4	5

More statements

Demographics:

My age is	< 18 years	18–25 years	26–40 years	46–65 years	> 65 years
My highest level of education is	Primary school	Second-ary school	Appren-ticeship	Uni degree	Uni higher degree (Masters/ PhD)
I have been employed full time for	< 1 year	1–5 years	6–10 years	11–15 years	> 15 years
My house/flat has ? adult residents	1	2	3	4	> 4
I live ? kms from my place of work	< 3	3–10	11–20	21–50	> 50

More statements

Open statements:

1> What do you consider the best .....

2> What do you consider the worst ....

Thank you for your participation. A copy of the report will be available on the web site http://xxx

Salient sections in the survey instrument.

- **For statements, respondent should rank answers to survey statement according to 4,5,7 or 10 points scale (Likert Scale)**
- **The 5 & 7 point scales allow for neutral or undecided answers.**
- **For some statements, it it may be appropriate for respondents to make no comment rather than commit to a view that biases results; this requires an additional column for *Not Applicable/No Opinion/Don't* Know**

DESIGN OF SURVEY STATEMENTS

Appropriate construction of *Survey Statements* is central to achieving reliable outcomes.

General guidelines are:

- **Statement should all be +ve, e.g., "I encourage learners most of the time" (note the -ve wording), rather than, "I don't encourage learners most of the time"— generally, this will allow for quick response without respondents having to read each question very carefully.**

  [To visualize this requirement, please revisit your own disposition when you have had to respond to a questionnaire].

- **Statements should be short, plus the total number of questions must be small [see Priority Questions in the *BSc in Process Instrumentation & Automation* consultation questionnaire in Lecture 6 Resources folder], say 20 at most. Also, range of questions must be within the framework of the ethics approval given.**

- **Long surveys may be frustrating, therefore, it is useful to forewarn respondents of the expected time for completion.**

- **Statements must be concise & in clear language, e.g., (Poor), "ITB does not do a bad job in keeping us informed about workplace health & safety", as opposed to, "ITB does a good job in keeping us informed about workplace health & safety".**

DESIGN OF SURVEY STATEMENTS

Appropriate construction of survey statements is central to achieving reliable outcomes from the survey.

General guidelines …continued:

- **Statements should not attempt to trick respondents, even if it is for purposes of corroborating any response solicited earlier in the survey— The analysis, hence, outcome of survey may be hampered if answers are contradictory.**

- **Statements must be confined to single themes, i.e., no double statements— if two concepts are used, it may be impossible for respondents to choose. For example:**

  Consider the statement, "I am satisfied with the audio & dashboard lighting in this car ".

  If there is a problem with the audio & not the dashboard lighting, the respondent cannot convey appropriate information via the single score.

- **Better statements are:**

  "I am satisfied with the audio system in this car "

  "I am satisfied with the dashboard lighting in this car "

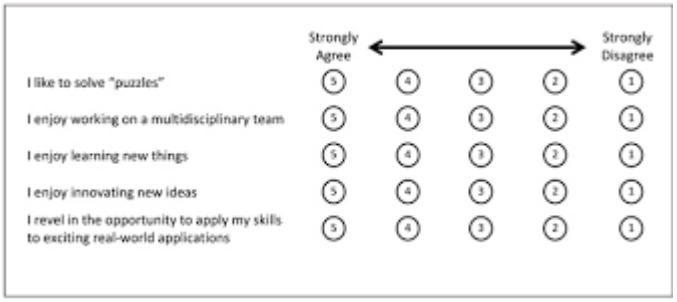
DESIGN OF SURVEY STATEMENTS

Appropriate construction of survey statements is central to achieving reliable outcomes from the survey.

General guidelines …continued:

- **Statements should not use emotive language to direct respondents' feeling.**
- **Comparative statements must not be used. For example:**

"This car compares well with my previous car" (a comparison statement– cannot elicit response for those who have never owned a car before).



ADMINISTERING THE SURVEY

Methods for administering surveys include: Paper surveys, telephone surveys, &; Online surveys. Each posses advantages & disadvantages

- **Paper survey—** distributed using mail (post or electronic) & respondent returns using scanned pdf or prepaid envelope. Participation requires mail or email address, but some sections of population have neither (by choice or disadvantaged).

[Can the class outline examples under disadvantaged population in this?]

- **Telephone survey—** achieved through random selection of contact numbers from public telephone directories. Respondent population limited those in directory (Ex-directory are unavailable) & who can be contacted at the time of day when they would be available.
- **Online survey—** response solicited via email & social media, therefore biased to the methods of communication.

RESPONDENT SELECTION

Stakeholders must be clearly identified/identifiable

Respondents will participate in a survey because:

- **Public Good— sees outcome to be of benefit to area, local community, country, etc., e.g., to reacting +vely for expansion of LUAS network to a residential area may benefit local community in terms of accessibility to public transport network.**
- **Personal Good— sees future benefits at personal level, e.g., to react +vely for expansion of LUAS network to a residential area may benefit local community but at the same time benefits individual in terms of increased property value.**
- **Personal reward— if respondents automatically & unanimously qualify for gifts (Any Example?), or respondents entered to a prize draw/lottery.**

[Allocation of personal rewards will have implications for ethics approval]

- **After identifying stakeholders, likelihood of biases must be reviewed to minimized the potential for dominating sub-groups— can be managed by questions under demographics.**

SURVEY TIMELINES

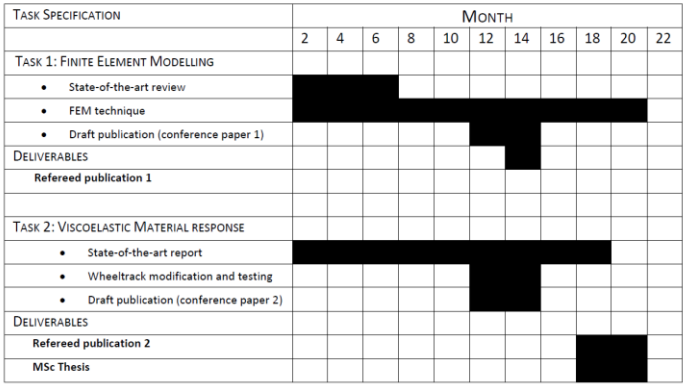
Management of survey timeline is critical to successful research.

Sample survey timelines may be as follows:

Week/ Date	Survey activity
0	Granting of ethics approval
1	Send out pre-survey letter of introduction/research context/research plan
2	Send out survey to potential respondents
3	Send out mid-survey reminders
4	Send out final reminders
7	Analysis & post-survey preliminary report to respondent [if required]
8	Acknowledgment note to stakeholders with outline of major conclusions [if required]
//	AOB

Survey timeline should fit in Project schedule

Project Schedule / Timescale



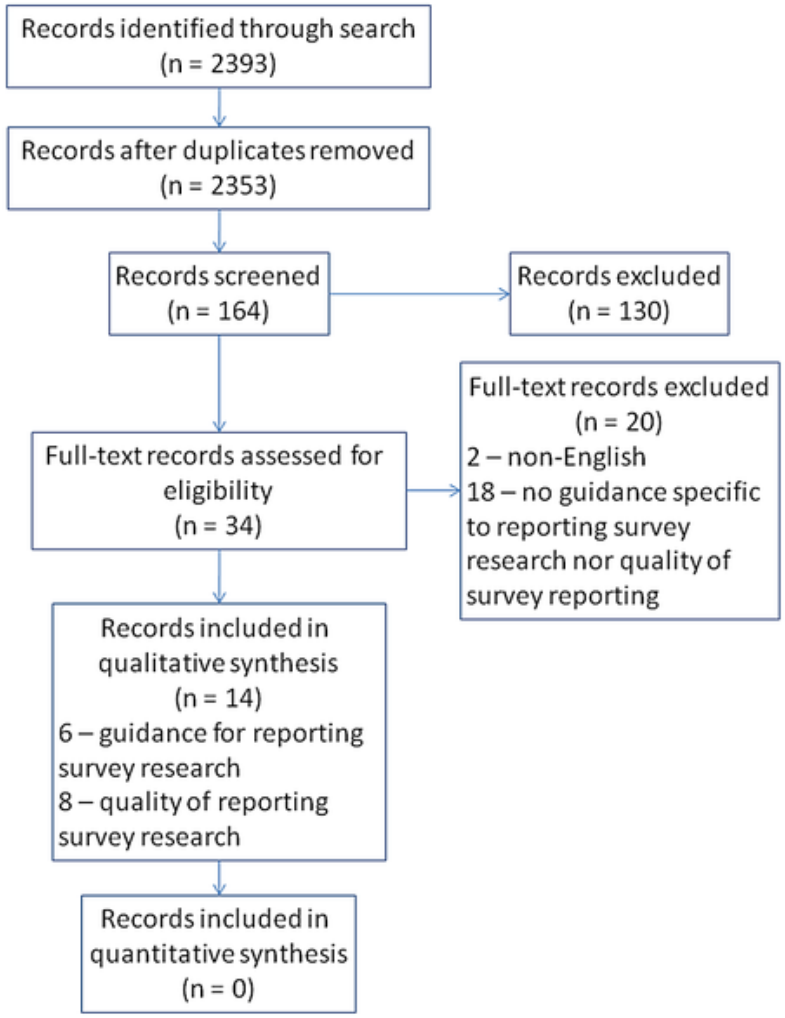
TASK SPECIFICATION	MONTH										
	2	4	6	8	10	12	14	16	18	20	22
TASK 1: FINITE ELEMENT MODELLING											
• State-of-the-art review	■	■	■								
• FEM technique	■	■	■	■	■	■	■	■	■	■	
• Draft publication (conference paper 1)						■	■				
DELIVERABLES							■				
Refereed publication 1											
TASK 2: VISCOELASTIC MATERIAL RESPONSE											
• State-of-the-art report	■	■	■	■	■	■	■	■	■		
• Wheeltrack modification and testing						■	■				
• Draft publication (conference paper 2)						■	■				
DELIVERABLES											
Refereed publication 2									■		
MSc Thesis									■	■	

There are many straight forwards methods of analysis.

- **A 5 point survey with 50 respondents & 25 statements (including demographics) results in 25 x 50 element matrix.**
- **All responses converted into numbers [Recall Likert Scale], & *Response Histograms* can be determined for each question etc.**

- **Possibility of *Multidimensional Correlation Analysis* [Recall from Lecture 9 Regression]**
- **It may be of interest to characterize response of sub-populations, based on demographics— *Unpaired t-Test* to compare the sample population means, & determine if the populations are indeed different.**
- **Where, by design, the individual respondents may have been survey twice (before & after), *paired Student t-Test* may be used to check for change in responses.**
- **Survey of two different populations by design, allows for comparison in unpaired t-Test to ascertain if any difference exists between the two sample populations.**
- **Typical Scientific Reporting is required to define outcome…..** **See Lecture 10 Later.**

Reporting Guidelines for Survey Research



Source: Carol Bennett , Sara Khangura, Jamie C. Brehaut, Ian D. Graham, David Moher, Beth K. Potter, Jeremy M. Grimshaw. 2011. Reporting Guidelines for Survey Research: An Analysis of Published Guidance and Reporting Practices (Available online at: http://dx.doi.org/10.1371/journal.pmed.1001069)<Accessed: March 27, 2017>

LECTURE 6 EXERCISE QUESTIONS

(1) Add the word 'survey' to your discipline's keywords in a scientific/humanities search engine & inspect the search findings. Read one or more of the papers identified/located &: check the method used for the selection of respondents; check the method used for reporting. Write an 800 word summery of the research methods & outcomes from the research paper.

(2) From literature (textbooks & journals only), check for the mean & SD of height & weight for adults in Europe/Ireland. What effect should this have on : (a) the seat size in public transport; (b) the ceiling height of buildings?

(3) From literature (textbooks & journals only), check for the mean & SD of oxygen consumption of fit adult humans who will be involved in a spacecraft or underwater employment. From this information, calculate the volume of the air required per person per minute.

(4) From literature (textbooks & journals only), check for the mean & SD of running speed of children aged between 5-10 years. From this information, estimate how long it would take to evacuate a primary school class of 20 students through a 70 m long corridor.