МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ
ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ
«САМАРСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ ИМЕНИ АКАДЕМИКА С.П. КОРОЛЕВА»
(САМАРСКИЙ УНИВЕРСИТЕТ)

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НАУЧНАЯ СТАТЬЯ НА АНГЛИЙСКОМ ЯЗЫКЕ: СТРУКТУРА И ЭЛЕМЕНТЫ

Рекомендовано редакционно-издательским советом федерального государственного автономного образовательного учреждения высшего образования «Самарский национальный исследовательский университет имени академика С.П. Королева» в качестве учебного пособия для обучающихся по основной образовательной программе высшего образования по направлению подготовки 03.04.01 Прикладные математика и физика

САМАРА
Издательство Самарского университета
2019

УДК 811.111(075)
ББК 81.2я7
Т 529

Рецензенты: канд. филол. наук, доц. В. И. Т р о ш к и н а,
д-р филол. наук, доц. В. Д. Ш е в ч е н к о

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Т 529 **Научная статья на английском языке: структура и элементы:** учеб. пособие / *Т.В. Толстова***.** – Самара: Изд-во Самарского университета, 2019. – 112 с.: ил.

ISBN 978-5-7883-1391-7

Данное пособие призвано научить писать научные статьи на английском языке для международных журналов. Оно знакомит с основными разделами научной статьи и базовыми компонентами для каждого раздела. Знание этих компонентов, а также устойчивых фраз и клише, используемых в них для реализации той или иной коммуникативной функции, позволяет даже начинающим авторам (владеющим английским языком уровня B1) создавать самостоятельные тексты, соответствующие основным требованиям международных издательств. Наличие большого числа рисунков и схем, а также набор проверочных заданий и упражнений облегчает и ускоряет процесс обучения.

Предназначено студентам, обучающимся по направлению подготовки 03.04.01 Прикладные математика и физика, аспирантам и научно-педагогическим работникам, желающим усовершенствовать навыки академического письма.

УДК 811.111(075)
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ISBN 978-5-7883-1391-7

Contents

Preface

This manual is aimed at those who want to learn how to present the findings of their research work in English and to publish articles in established international journals according to an accepted standard format.

The readers are offered a basic ‘minimum’ underlying any research paper, which is inescapable if an author is going to become part of the international scientific community. This minimum serves a foundation for generating more complex and profound research texts corresponding to the researcher’s professional level.The information is presented in a very concise and schematic way, which facilitates its understanding and memorizing, and can later lead to a more detailed discussion of the relevant issues.

The book consists of twelve units corresponding to the essential components of a journal article. Apart from the overall structure of a research paper conventionally consisting of the four main parts – *Introduction, Methids, Results and Discussion* (IMRaD) – the manual describes more specific communicative elements (*moves*) for each of these parts as well as typical groups of words or sentences (*skeleton phrases*) which allow the readers to build their own coherent and meaningful texts.

Each unit is provided with explanations, lists, tables and diagrams for better understanding the topics as well as with excercises and assignments for practicing the material. The illustration material consists of authentic research paper fragments representing various fields of knowledge making the book universal in its scope.

The manual is intended for the learners of B1 level and above (according to the Common European Framework of Reference, CEFR), however it can be suitable for researchers who are only beginning to master the English language.

Therefore, the desired goal of the manual is to serve as both a guide and template thus simplifying the drafting of high quality comprehensible research articles of your own.

Unit 1. Organising scientific papers

The overall structure of a research paper

- **Title**
- **Author(s)**
- **Abstract**
- **Key words**
    - **Body** (*see below*)
- **References**
- **About the authors**
- **Acknowledgement** *(optional)*

Body

The standard **IMRD** (or **IMRaD**) format (*see the scheme below*):

Introduction
Methods (and materials)
Results
Discussion

PURPOSES:

Introduction

- to provide the rationale for the paper moving from general discussion of the topic to the particular question of hypothesis being investigated
- to attract interest in the topic – and hence readers

Methods

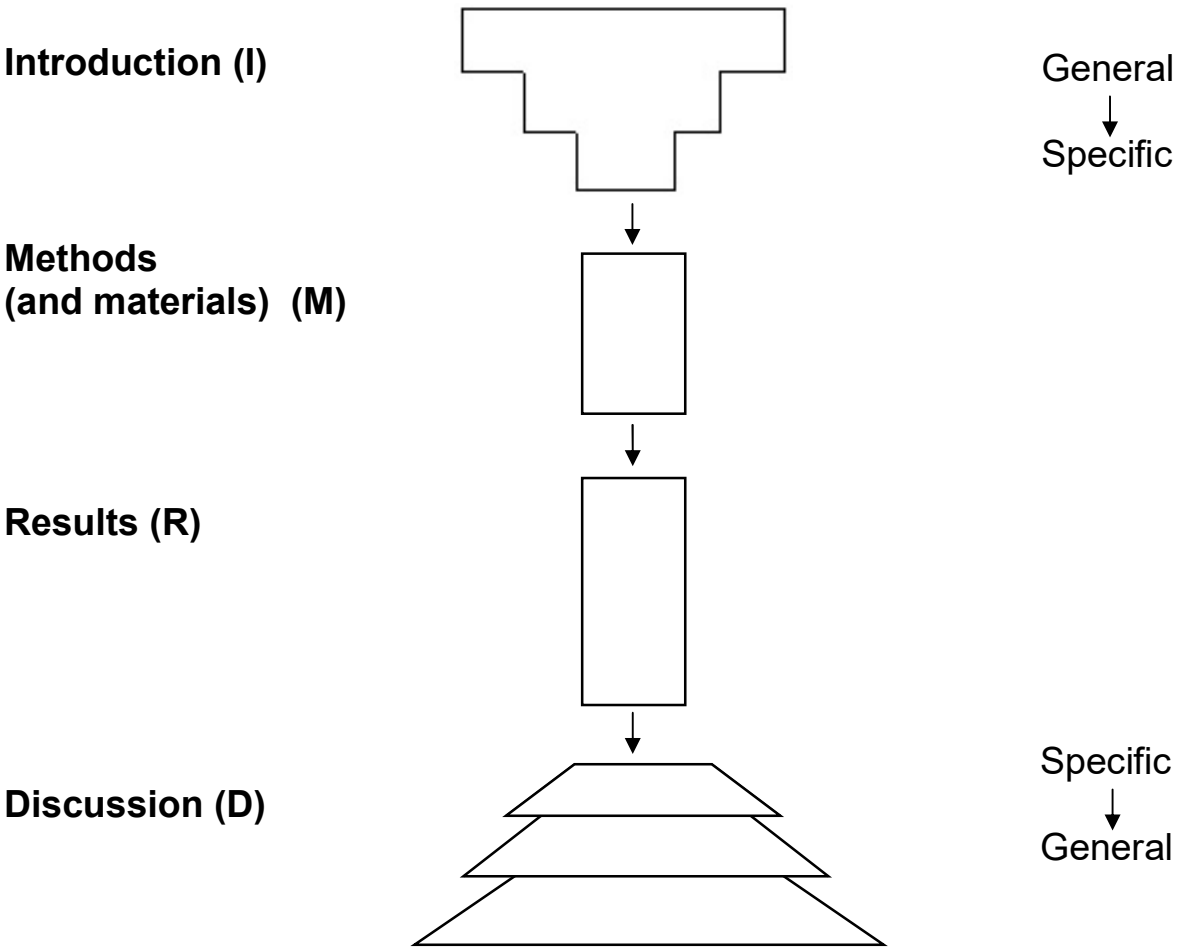
- to describe, in various degrees of detail, methodology, materials (or subjects), and procedures. This is the narrowest part of the research paper

Results

- to describe the findings, give commentary

Discussion

- to offer a generalised account of what has been learned in the study. This is usually done through a series of "points" some of which refer back to the statements made in the **Introduction**



Overall shape of a research paper

EXERCISES

Ex. 1

Scientific papers are typically divided into five sections:

1. Introduction
2. Materials and Method
3. Results
4. Discussion
5. Bibliography

Each section answers a different question. The answered questions in these sections are:

a. What do the Results *mean*?

b. What was *found/discovered*?

c. What is the *background* and *aim* of the investigation?

d. What literature *sources* are referenced in the paper?

e. What was *done* in the investigation?

Complete the table to match each section (1–5) to the question it answers (a–e).

1.	
2.	
3.	
4.	
5.	

RESEARCH TEXT – 6 STEPS

Look through the article in Appendix 1.

Step 1: Navigating and positioning a text using publication details

Task 1: Highlight or underline the following information:

- Name of the journal
- The volume number of the journal
- The issue number of the volume (if found)
- The year of publication
- The first and the last page numbers of the article
- The title of the article
- The names (surnames and initials) of the authors.

Step 2: Genre, audience, and purpose

Task 2: Think about the following questions:

1. What type of article* is this?
   - a research article
   - a review article
   - another type of article (e.g. a theoretical paper)
2. Who do you think it is written for (more than one answer is reasonable)?
   - graduate students or undergraduate students
   - researchers and/or lecturers and/or professors
   - novices or experts in carbon sequestration
   - a national audience or an international audience
3. Why has the article been written? Look at the title of the article.
   - What does 'carbon sequestration' mean?
   - Which method of 'carbon sequestration' does the article focus on?
   - What does the article review?
   - Who funded the research (Tip: look for 'acknowledgements')

*Note: *Science Direct* has 3 categories of article: 'research' articles; 'review' articles; other articles. In a list of search results you will see the words 'research' or 'review' under the title of the article. If you do not see a word under the title this means that the article is categorised as 'other'.

Glossary: 'sequestration' refers to the process of capturing and storing something (e.g. carbon)

Step 3: Context and essential elements

Task 3: **(i)** Answer the questions then **(ii)** label the lines in the abstract with the words in bold and write page numbers for the relevant sections (see 'Contents'):

1. Which academic discipline or field do you think the authors work within?
2. Where can you find a summary of the whole article?

Background (i.e. an introduction to the topic)
Aims (i.e. the objectives of the review)
Method (i.e. how the data were analysed)
Results (i.e. the findings of the review)
Conclusion (i.e. evaluation of the findings)

Step 4: Meaning

Task 4: Copy relevant sentences (or parts of sentences) from the abstract into the notes outline and summarise the results of the review in 1-2 sentences. Remember to use quotation marks ('..') around phrases and sentences copied from the text.

Citation:	Huang, Liu, Shao, and Xu, 2012: 1291 Carbon sequestration by forestation across China: Past, present, and future
Aim 1: Aim 2: Main point 1: (Aim 1) Main point 2: (Aim 1) Main point 3: (Aim 2):	
Summary	

Glossary: 'Pg C' = petagrams of carbon

Step 5: Language

Task 5: List vocabulary related to **(i)** the topic **(ii)** analysis.

Example:

Topic-related vocabulary: Carbon sequestration, forestation, ……..

Vocabulary related to 'analysis': rate, applied … to, empirical growth curves, ……

Dictionary work:

a) For **academic vocabulary** fill the table taking into account *word class* (i.e. part of speech), *collocations* (i.e. phrases), *countability* (whether the noun is countable (e.g. disc) or uncountable (e.g. air)).

Word class	Academic vocabulary related to 'analysis'
Nouns & noun phrases (countable):	
Nouns & noun phrases (uncountable):	
Adjectives:	
Prepositions:	
Verbs:	
Adverbs:	

b) Using the ***Academic Word List*** by Averil Coxhead (See Appendix 2) highlight the most frequent academic words.

Step 6: Critical thinking and evaluation

Task 6: Consider the method, results, and conclusions:

Method and results

1. Which methodological approach to data analysis are the authors' conclusions based on?
2. Using your own knowledge: What are the advantages/disadvantages of this approach?
3. How do projected figures for 2010-2050 compare with estimated figures for 1950-'present' (e.g. as a proportion)?
4. Do the projected figures seem low/reasonable/high?

Conclusions

Conclusion 1: 'Carbon Sequestrations were highest in North China'

Conclusion 2: 'Changes were generally greatest in the Northeast and Southwest regions'

1. Which words or phrases show evaluative judgments?
2. According to the abstract, which variable or parameter are these evaluative judgments based on?
3. Could these judgments be based on (an)other parameter(s)?

Task 7: Do the 6 STEPS for a research article in your field of interest.

ASSIGNMENT 1

1.1. Find 5-6 articles in your research area.

1.2. What is their structure?

1.3. Is it different from the IMRD? Which parts are missing? Which extra parts are present?

1.4. Which structure do you find the best? Why?

1.5. Think of the structure for your paper.

Unit 2. Methods

The **Methods** section is considered to be the easiest to write.
Therefore, it is often written first.
Sometimes other terms are used:

- Methods and Materials
- Experiment
- Experimental
- Experimental Details
- Procedure
- Method Description and Validation
- Methodology
- Model
- Data Collection and Analytical Framework

It may have subsections:

- Materials
- The apparatus used
- Definitions employed
- The subjects or participants in the study
- The statistical procedures used

STRUCTURE

- What did I study?
- What hypotheses was I testing?
- Where did I carry out this study and what characteristics did this location have?
- How did I design my experiment and what assumptions did I make?
- What variable was I measuring and why?
- How did I handle my materials?
- What kind of care / precautions were taken?

- What equipment did I use (plus modifications) and where did this equipment come from (vendor source)?
- What protocol did I use for collecting my data?
- How did I analyze the data? Statistical procedures? Mathematical equations? Software?
- What probability did I use to decide significance?
- What references to the literature could I give to save me having to describe something in detail?
- What difficulties did I encounter?
- How does my methodology compare with previously reported methods, and what significant advances does it make?

TYPES

The Methods sections can be long and detailed or short and concise. According to this, they are divided into three types:

- **condensed** (natural sciences and engineering)
- **extended** (social sciences)
- **intermediate**

LANGUAGE FEATURES

- **clear account of methods and procedures**
- **justifications, explanations, examples**
- **repeated terms**
- **linking phrases *(however, therefore,* etc.*)***
- **Present Simple, Past Simple**
- **passive**

EXERCISES

Ex. 1

Consider this first part of the methodology for a research paper written by a doctoral student in information and library science and then answer the questions that follow.

The purpose of this research project is to study the effects on scientists of the new collaboratories (or dispersed virtual research communities); in this case, the collaboratory is now called the Space Physics and Aeronomy Research Collaboratory, or SPARC.

Methodology

Data Collection

① Data used in this research consists of two parts: Survey data and data on coauthorship. ② Survey data were collected from 1993 to 1996. ③ In the summer of 1993, a baseline survey was administered to a group of scientists who were likely users of UARC/SPARC. ④ Prior to the commencement of data collection for the baseline survey, a letter was sent to every member of the group, notifying them of the forthcoming survey and informing them of its length, that their participation was confidential and anonymous, and that upon completion of the survey, they would be entered into a $100 cash incentive lottery. ⑤ The sample size of the UARC/SPARC target group was 94 and the response rate was 65%. ⑥ A questionnaire consisting of 32 items was sent to all of the participants. ⑦ The items asked specifically about the scientists' communication behaviour and social networks within the space science community. ⑧ The questionnaire was designed to allow the participants to complete it within thirty minutes to an hour.

⑨ After administration of the baseline surveys in 1993, the UARC/SPARC target group was surveyed annually from 1994 through 1996. ⑩The 1994 survey was also a mail survey. ⑪ In 1995, the survey was administered via telephone, which lasted 15 to 20 minutes. ⑫ In 1996, an email/web based survey was used in conjunctions with a telephone interview. ⑬In all years, the incentive scheme used was similar to that used in 1993. ⑭ In all years, scientists were asked questions about their research behaviour, the use of the UARC/SPARC, and social networks within the space science community.

⑮ Coauthorship data were based on the examination of the publications of UARC/SPARC users from 1993 to 1996. ⑯ Data were collected from the *Science Citation Index*. ⑰ Data on whom the scientists were coauthoring with were examined.

1. Of the 17 sentences in this subsection, which is the shortest sentence and which is the longest?

2. All the questions are in the past tense except for one. Which is it?

3. Does the writer believe that data is singular or plural?

4. This is the "data collection phase" of her methodology. What do you think the next part contains: *(a)* description of the survey participants; *(b)* methods of analysis; *(c)* description of the statistical procedures?

5. Where is the potential choice, all sentences are in the passive. Suppose her advisor say to her, "We can use *we* sometimes too." Which three sentences in the Methods section do you think are particularly suitable for changing into the active? Why did you choose those three?

6. List all the phrases or clauses that come before the main clause. Also identify their sentence numbers? What kind of phrases and clauses are they? What does that tell us?

7. The text informs us in sentence 1 that two kinds of data were collected. The survey data is described is a quite *extended* manner, while the description of the coauthorship data is *condensed*. Her advisor is not very happy with this. He says that sentences 2-14 should be cut down and that sentences 15-17 should be extended. Revise either sentences 2-14 or sentences 15-17.

Ex. 2

a) The table below gives us a kind of rough "Scorecard" for *Methods* sections, if we subtract a point for each element under **Condensed** and add a point for each one under **Extended**. For example, the coauthorship data (sentences 15-17) from the text in Exercise 1 would score a *–7* (every element in the **Condensed** column except for a running series of verbs).

Condensed	Extended
Assumes background knowledge	Sees need to provide background
Avoid named subsections	Several named subsections
Uses acronyms and citations as shorthand	Uses descriptions
Running series of verbs (e.g. *collected, stained, and stored*)	Usually one finite verb per clause
Few "by + verb-ing" "how" statements	A number of "how" statements
Few definitions and examples	More definitions and examples
Few justifications	Several justifications (often initial purpose clauses)
Few linking phrases	Wide range of linking phrases

b) Using the "scorecard" in the table, what score would you give sentences 2-14 of the text in Exercise 1?

c) What score would you give the following extracts?

A

Methods for Analysis and Functional Properties

The standard AOAC methods (AOAC, 1975) were used for the determination of total solids, nitrogen, crude fat, ash, and Vitamin C. Total sugars were determined by the method of Potter et al. (1968), and the total carbohydrates (in terms of glucose) were assayed according to the procedure of Dubois et al. (1956). The method of Kohler and Patten (1967) was followed for determining amino acid composition. (Quoted by Knorr-Cetina 1981, 157).

B

> To detect groups among the specimens and extract variables that best diagnose the groups, we used principle components analysis (PCA). Before conducting the analysis, we standardized all measurements so that each variable would have a mean of 0 and a standard deviation of 1. For the PCA, we included only continuous characters. To avoid weighting characters, we excluded characters that are probably genetically redundant, as revealed by high values for the Pearson correlation coefficient between all possible pairs of characters. (Naczi, Reznicek, and Ford 1998, 435).

Ex. 3

Many *extended* Methods have a number of such linking phrases that operate to tie the longer sections together and to add some stylistic variety. How many of these can you turn into complete sentences?

1. In an effort to reduce _____.
   _____
2. In order to establish _____.
   _____
3. For the purposes of this study, _____
   is defined as _____.
4. Based on the feedback from the pilot study, _____
   _____ .
5. On the basis of the literature review described above, _____
   _____.
6. With the exception of _____.
7. During data collection, _____.
8. In the interest of generating maximally useful data, _____
   _____

ASSIGNMENT 2

2.1. Look through the article from your research area and find the section which relates to **Methods**.

2.2. What is the section called?

2.3. What is the structure of the section?

2.4. Using the "scorecard" from this unit, decide if the **Methods** section is condensed or extended.

2.5. What linking words are used in the section?

2.6. What clichés or 'skeleton phrases[1]' are used in the section?

2.7. Write a draft of the Methods section (100-150 words) for your own article. State the name of the method, explain your choice, describe the nature of the method and its procedure. If necessary, include the material.

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 3. Results

RESULTS vs DISCUSSION

only report the data collected

or?

include evaluation and commentary

FOUR TYPES OF THE "RESULTS" SECTION

1. **Gives straightforward description of the author's results; includes no commentary at all**
2. **Is mostly restricted to present findings, but includes a few uses of commentary**
3. **Consists of both description of findings and a number of commentary elements**
4. **Makes heavy use of commentary; could be taken for a discussion**

COMMENTARY

1. **Justifying the methodology**
2. **Interpreting the results**
3. **Citing agreement with previous studies**
4. **Commenting on the data**
5. **Admitting difficulties in interpretation**
6. **Pointing out discrepancies**
7. **Calling for further research**

STRUCTURE

1. **What did I find?**
2. **What did I not find?**
3. **What did I find that I was not expecting to find?**

BEGINNING

1. **Give a general panorama of your surveys, experiments, etc. without repeating the details you gave in the Methods section:**

- Overall, the results presented below show that … .
- The three key results of this empirical study are … .
- The following emerging schemes were identified from the analysis: ….

2. **Go directly to your results (often by inviting readers to look at one of your figures or tables):**

- Figure 1 shows the mass spectra obtained from an analysis of the two residues. The first residual reveals a … . (Fig. 1a)
- A total of 34 wheat genotypes (Table 1) were screened for … . Responses to increased sunlight varied significantly (Figure 1)… .
- An analysis was made to look for … To do this, the average times of x and y were compared … .Figures 1-3 show the differences between ….

THE REST

1. **Highlight those results that answer your research question**
2. **Outline secondary results**
3. **Give supporting information**
4. **Mention any results that contradict your hypothesis and explain why they are anomalous**

TABLES AND FIGURES

TWO types of illustrations:

- **tables**
- **figures**

You should NEVER label something "Chart A" or "Graph B."

Use a table	Use a figure	Use text
To show many and precise numerical values and other specific data in a small space.	To show trends, patterns, and relationships across and between data sets when the general pattern is more important than the exact data values (graphs and data plots).	When you don't have extensive or complicated data to present.
To compare and contrast data values or characteristics among related items or items with several shared characteristics or variables.	To summarize research results (graphs, data plots, maps, and pie charts).	When putting your data into a table would mean creating a table with 2 or fewer columns.
To show the presence or absence of specific characteristics.	To present a visual explanation of a sequence of events, procedures, geographic features, or physical characteristics (schematic diagrams, images, photographs, and maps).	When the data that you are planning to present is peripheral to the study or irrelevant to the main study findings.

‘Showing not telling’:

COMMENTS ON TABLES AND FIGURES

1. Figure 4 shows the relationship between the numbers of Species A and Species B. ✗
2. The abundances of species A and B were inversely related (Figure 4). ✓

THE VALUE OF YOUR FIGURES

1. The large difference in mean size between population C and population D is particularly *interesting* ✗
2. While the mean size generally varies among populations by only a few cm, the mean size in population C and D *differed by 25 cm*. Two hypotheses could account for this … ✓

LANGUAGE FEATURES

Past Simple

- **Passive** (when the topic is the most important element):

  The care model, *was seen* as a credible and holistic approach to the management of depression.

- **Active** (more sense to use a human subject):

  GPs *were keen* to avoid ‘over-medicalising’ and over-prescribing of antidepressants.

Present Simple

- **to indicate an established scientific fact**

Past Simple

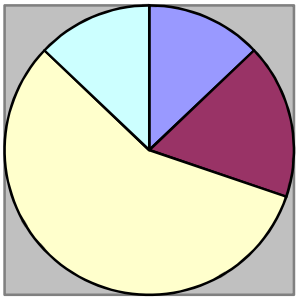
- **to talk about your findings**
- **(+ references to figures)**

Linking words

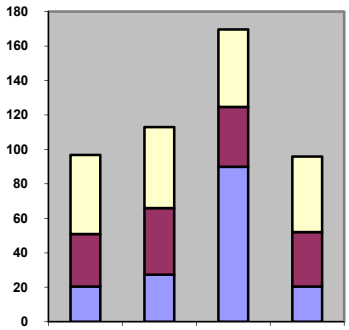
- **sequence**: *first, second,* etc., *then, finally*;
- **cause and effect**: *thus, therefore, as a result*;
- **contrast**: *however, on the other hand, but, nevertheless, yet, in contrast;*
- **addition**: *also, in addition, furthermore, moreover, further;*
- **clarification**: *i.e. (that is), for example, in other words*.

TYPES OF ILLUSTRATIONS

The *Results* section enables you to present your data (findings or results) to show what you found and whether it matched your expectations. You have to decide on the relevance of different types of illustrations.



A **pie chart** has good visual impact but does not show movement.



Bar charts (**histograms**) can be presented vertically or horizontally. They are particularly good for making comparisons.

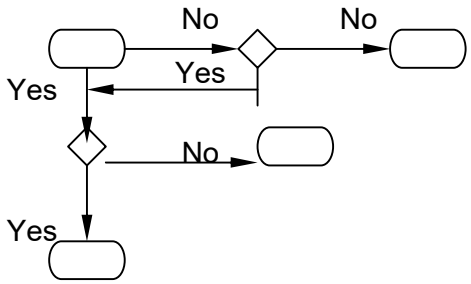
Tables give very precise information, but their visual impact is very poor and they may be difficult to read.

FACEBOOK USERS IN THE USA

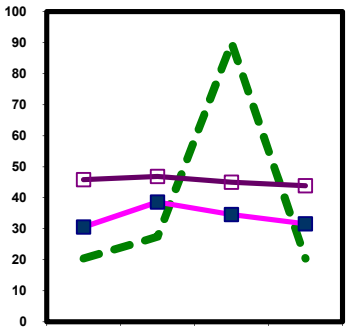
Alabama	1,599,26033
Alaska	6,440
Arizona	2,448,140
Arkansas	989,820
California	16,673,720
Colorado	2,369,420
Connecticut	1,398,220
Delaware	216,140
District of Columbia	1,576,360
Florida	7,839,520
Georgia	4,841,900

Flow charts

Flow charts are used to illustrate the stages in a process. The branches show when a decision has to be made.



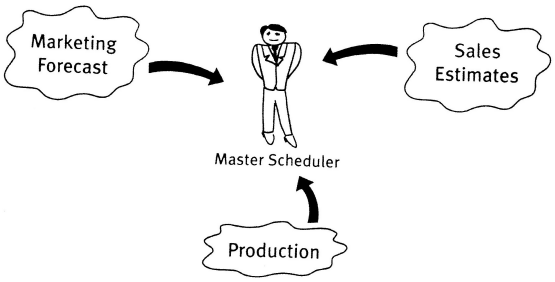
Graphs

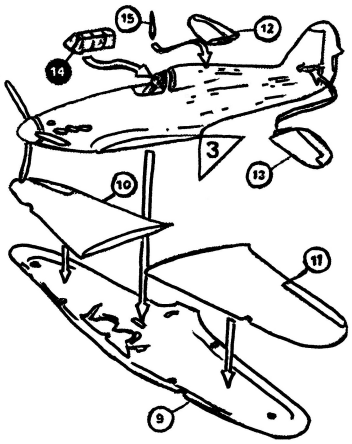


Graphs are good for showing movements and how one thing varies against the other.

Diagrams

A diagram is an illustration designed to show how a machine or system functions.





Pictograms use no words

EXERCISES

Ex. 1

Discuss the questions.

1. What is the difference between a *table* and a *figure* in a scientific paper?
2. Should the *Results* section always include tables or figures, or can the results be expressed by text alone?
3. Should the title of the figure or table be above or below it?
4. What do you think makes tables and figures easier to interpret?

Ex. 2

Discuss the questions.

Tables 1 and 2 present the same information, but in different formats. Look at them and discuss the questions below.

Table 1: Characteristics of three populations of *Daphnia* species collected at Rye Meads Pond on 3 June, 2011

species	average length (mm)	average number of eggs	average number of animals per L
Daphnia magna	5.01	15.3	112.5
D. obtusa	2.33	8.2	68.7
D. longispina	2.77	6.8	40.4

Table 2: Characteristics of three populations of *Daphnia* species collected at Rye Meads Pond

species	*Daphnia magna*	*D. obtusa*	*D. longispina*
av. length (mm)	5.01	2.33	2.77
aver. number of eggs	15.3	8.2	6.8
av. number of animals	112.5	68.7	40.4

1. The differences between Tables 1 and 2 (think about differences in organisation, titles, the use of abbreviations, the inclusion of units).
2. Which of the tables is better organised, easier to read and makes it easier to compare results?
3. Is it appropriate to show this information in a graph?

Ex. 3

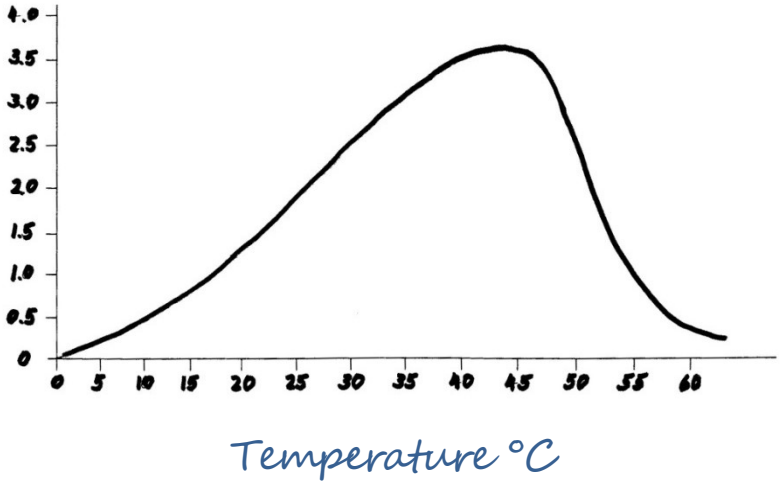
What features make a good table? Think about how to:

1. show your data to make it easy to compare significant information
2. give units, arrange numbers, use abbreviations
3. give table and figure numbers, and titles

Ex. 4

The results below are taken from a student's laboratory notebook, and are followed by a graph that the student made based on the data to include in a written report. Discuss the strengths and weaknesses of the graph.

Temperature °C	Rate of reaction, mg. products per hr
0	0
5	0.3
10	0.5
15	0.9
20	1.4
25	2.0
30	2.7
35	3.3
40	3.6
45	3.6
50	2.3
55	0.9
60	0



Ex. 5

Draw an improved version of the graph on the graph paper below.

As you prepare your graph, you should consider the following questions:

a. Which is the independent variable (the one that the investigator can control or manipulate)?
b. Which is the dependent variable (the one that changes in response to the independent variable)?
c. Are the axes organised correctly?

Note: *The independent variable (the x-variable) is plotted on the horizontal or x-axis, and the dependent variable (the y-variable) is plotted on the vertical or y-axis.*

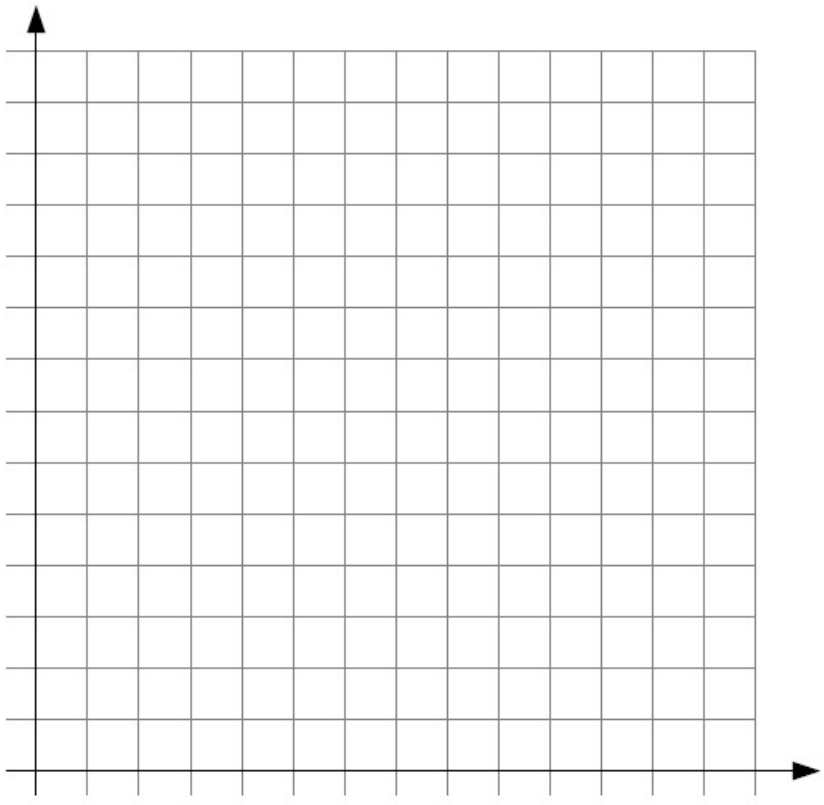
d. Are the scales appropriate?

Note: *Scales are chosen to make the plot fill the graph so that trends are easily visible.*

e. Are the axes labelled correctly, with units?
f. Are the data plotted accurately?

Note: *Since the data points are measured experimentally and therefore have some inherent experimental uncertainty, it is recommended that data points are plotted with a well defined symbol. For example, the following symbols are commonly used:* (●), (■), (□), (▲), (♦). *Use ONE type of symbol for ONE data set.*

g. Are the abbreviations correct?
h. Does the graph have a figure number and a title that enables the reader to understand what the graph represents?
i. Is the title written below the figure?



Ex. 6

Read the paragraph, taken from a *Results* section and find examples of:

a. use of the past tense in the active voice
b. a general statement describing an important finding
c. data that support the general statement

> Oxygen production varied depending on the pH of the solution (Figure 1). At pH 2, oxygen production was 3 ml, whereas at pH 7 it increased to a maximum of 6 ml. At pH values above 7, oxygen production decreased and was at a minimum of 1 ml at pH 10.

Ex. 7

Discuss what points you would include in a description of the results presented in the graph you drew in Exercise 5. Write a paragraph to describe the data.

Ex. 8

Match the words and expressions with the correct chart.

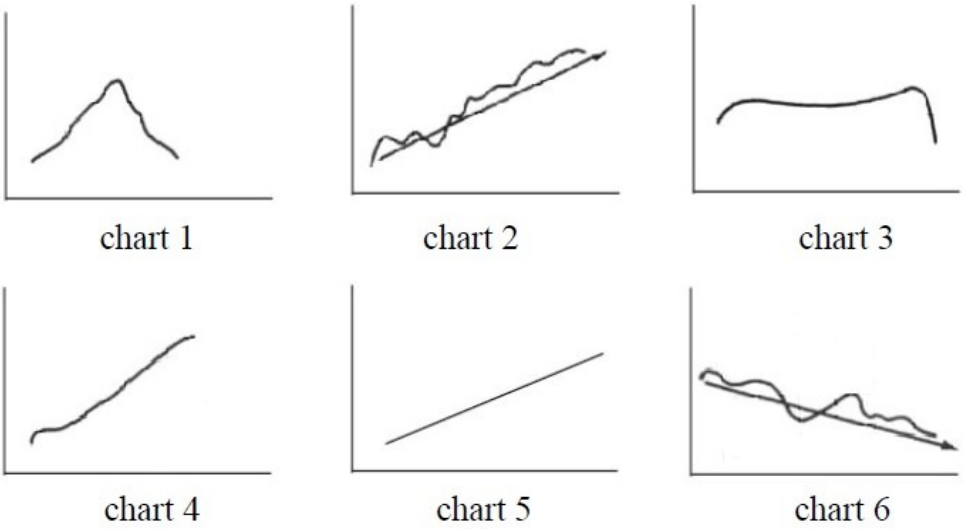
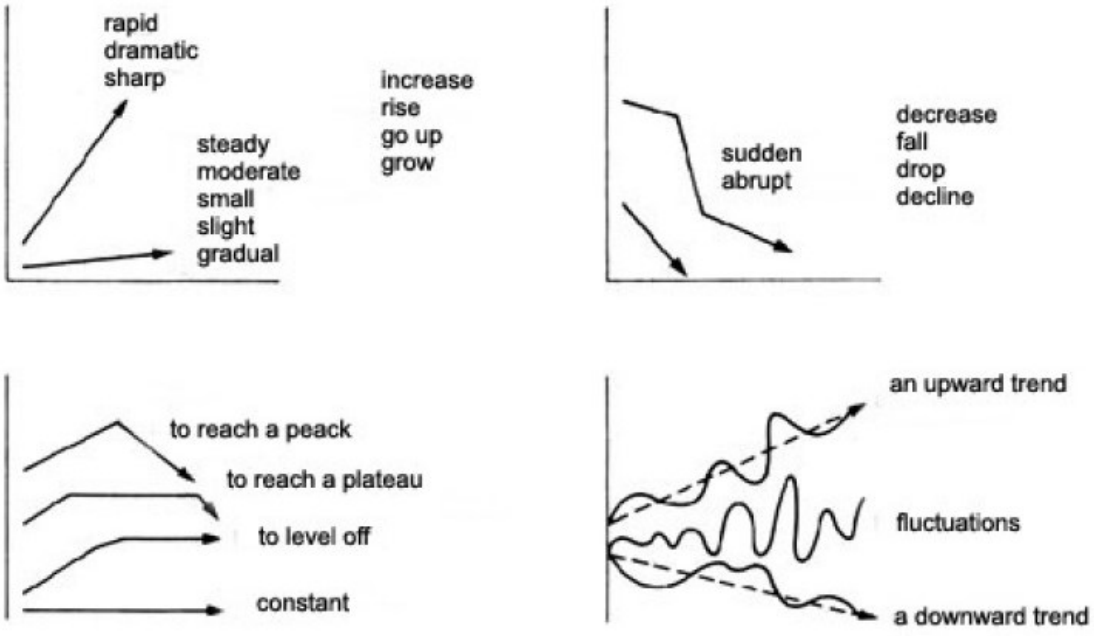


chart 1 chart 2 chart 3

chart 4 chart 5 chart 6

a. stable
b. steep
c. plateau
d. peak
e. downward trend
f. constant
g. gradual
h. rapid
i. gentle
j. stagnant
k. upward trend
l. level
m. sharp
n. steady
o. dramatic

Some more words which might be useful to describe a graph:

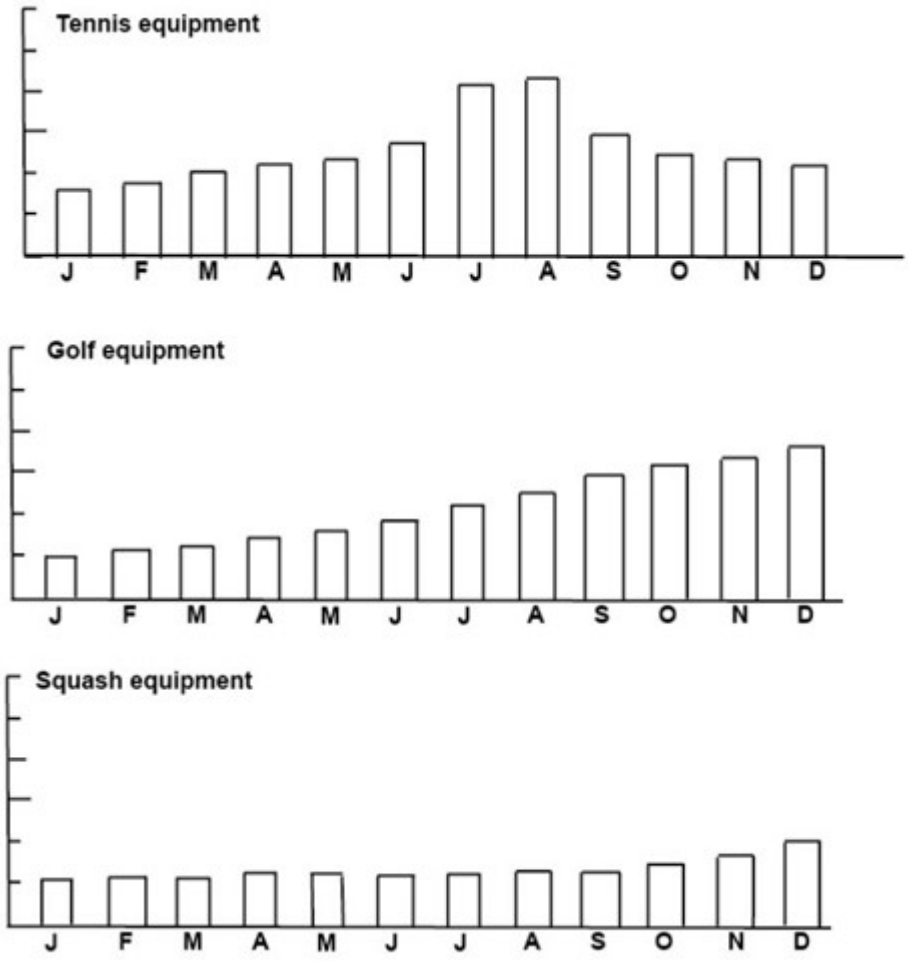


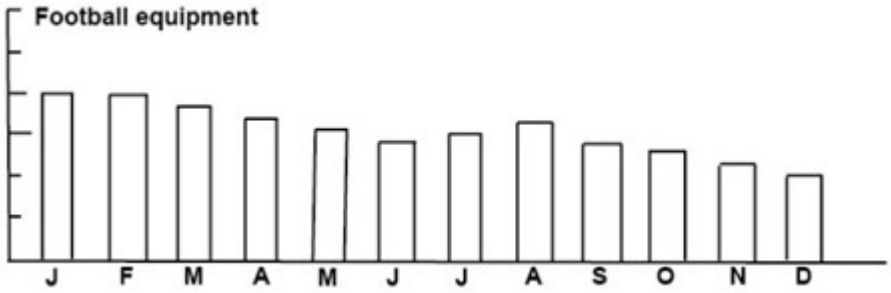
We can modify statements about change by using adjectives or adverbs which indicate the degree of change:

Quantity:	considerably a great deal very much	Impact	significant (ly) marked (ly) noticeable (ly)
	a lot rather somewhat quite a lot a bit a little slightly	Accuracy:	exactly precisely almost nearly roughly approximately

Ex. 9

Use the information in the following bar charts to complete the sentences:





1. Sales of tennis equipment were …….. higher in July and August.
2. They were …….. lower in December than in November.
3. There was a …….. downward trend in football sales over the year.
4. December sales were …….. half the January sales.
5. In fact the December sales were …….. 33 1/3% down on the June figure.
6. Golf equipment sales grew …….. in the first three months.
7. From April onwards, there was a …….. upward trend
8. By December they were …….. treble the January figure.
9. Squash sales had a …….. slower rate of increase than golf sales.
10. However, sales improved …….. over the last three months.

Ex. 10

Look at Table 1, read the data commentary, and then answer the questions below.

Table 1. Means of PC Virus Infection in U.S. Businesses

Source	Percentage
Disks from home	43%
Electronic bulletin board	7%
Sales demonstration disk	6%
Repair or service disk	6%
Company, client, or consultant disk	4%
Shrink-wrapped application	3%
Other download	2%
Disk from school	1%
Local area network supervisor disk	1%
Purposely planted	1%
Came with PC	1%
Undetermined	29%

(1) A computer virus is a program that is specifically designed to attack a computer system, destroying data. (2) As businesses have become increasingly dependent on computer systems, concern over the potential destructiveness of such viruses has also grown. (3) Table 1 shows the most common modes of infection for U. S. businesses. (4) As can be seen, in the majority of cases, the source of the virus infection can be detected, with disks being brought to the workplace from home being by far the most significant (43%). (5) However, it is alarming to note that the source of nearly 30% of viruses cannot be determined. (6) While it may be possible to eliminate home-to-workplace infection by requiring computer users to run antiviral software on diskettes brought from home, businesses are still vulnerable to major data loss, especially from unidentifiable sources of infection.

Questions:

1. Where does the data commentary actually start?
2. What are the purposes of sentences (1) and (2)?
3. Do you consider this commentary a problem-solution text?
4. What are some of the features of this text that make it an example of formal written English?
5. Which sentence contains the author's key point?
6. The author has chosen only to comment on percentages greater than 10%. Why? Do you think this is enough? If not, what would be a suitable additional sentence?
7. Undetermined sources constitute 29% of the total. In sentence (5), this is expressed as 'nearly 30%.' What do you think about this and these alternatives:
   a)over one-fourth of viruses:
   b)29% of viruses:
   c)as much as 29% of all viruses.

Many data commentaries begin with a sentence containing these two elements (see Table 2).

Table 2. Starting a Data Commentary

Location	**Summary**
a. Table 1 shows	the most common modes of computer infection for U.S. businesses
b. Table 2 provides	Details of the fertilizer used.
c. Figure 4. 2. gives	the results of the second experiment.

The Passive Voice can also be used to start a data commentary (see **Table 3)**

Table 3. Passives in Starting a Data Commentary

Summary	**Location**
a. The most common modes of infection	*are shown* in Table 1.
b. Details of the fertilizers used	*are provided* in Table 2.
c. The results of the second experiment	*are given* in figure 4. 2

Now notice that all the examples so far have been *indicative* (they just stated the fact without giving additional information). Alternatively, the writer could have given an *informative* summary:
a)Table 1 shows that home disks are the major source of computer viruses.
b)Table 2 gives the ingredients of the chosen fertilizers – SP401.
c)Figure 4.2 suggests that the experimental results confirm the hypothesis.

Linking as-Clauses

A more common structure for introducing informative statements is the linking *as*-clause. Here are three examples:

1.As shown in table 1, home disks are the most frequent source of infection.
2.As can be seen in figure 8, infant mortality is still high in urban areas.
3.As revealed by the graph, the defect rate has declined.

These linking clauses are exceptional in English grammar. In the passive, they have *no subjects.* Compare the following two examples:

a)As it has been proved, the theory may have practical importance.
b)As has been proved, the theory may have practical importance.

In *a)* there is a casual relationship between the *as*-clause and the main clause:
Because the theory has been proved, it may have practical importance.
In *b)* the *as*-clause serves to announce or confirm.

Using prepositions with this type of linking statement:

in	As shown *in* table 3, ...
from	As can be seen *from* the data in table 1,...
by	As shown *by* the data in table 1....
on	As described *on* page 24, ..
at	At the beginning of the year, unemployment stood *at* 1.400.000
by	Unemployment rose *by* 350,000.
from ... to	Unemployment rose *from* 1,400,000 *to* 1,750,000 during this year.
of	There was an increase *of* 350,000.

Ex. 11

Fill in the blanks with appropriate prepositions

1. As can be seen _____ figure 4, earnings have decreased.
2. As revealed _____ figure 2, the lightweight materials outperformed traditional metals.
3. As described _____ the previous page, there are two common types of summary statements.
4. As stated _____ the Appendix, *per* in *percent* or *km per hour* is a Latin preposition that originally meant *through* or *by*.
5. As described _____ the previous unit, passives are common in process descriptions.
6. As can be seen _____ a comparison of the two tables, household income is a more reliable predictor than level of education.
7. As is often the case _____ materials _____ this type, small cracks pose a serious problem.
8. As has been demonstrated _____ many similar experiments, these materials have many advantages.

ASSIGNMENT 3

3.1. Look through the article from your research area and find the section which relates to **Results**.

3.2. If not, are there other sections containing the findings of the research? What are they called?

3.3. Which of the four types of **Results** are they?

3.4. What linking words are used in the section?

3.5. What clichés or 'skeleton phrases[1]' are used in the section?

3.6. Write a draft of the **Results** section (200-300 words).

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 4. Introduction. Move 1a

In some kinds of texts it is possible to start immediately with a topic statement:

- The purpose of this paper is to … .
- This paper describes and analyzes … .
- In this paper, we report on … .

However, in a research paper it comes at or near the end of an **Introduction**.

Just as plants compete for light and space, so the writers compete for:

- **acceptance** and
- **recognition**

In order to obtain this acceptance and recognition, most writers use an organizational pattern, containing three "**moves**".

"Moves" represent a stretch of text serving a particular communicative function.

CARS Model

(Create-a-Research-Space)

Move 1	Establishing a research territory
	a. by showing that the general research area is important, central, interesting, problematic, or relevant in some way. (*optional*)
	b. by introducing and reviewing items of previous research in the area. (*obligatory*)
Move 2	Establishing a niche
	a. by indicating a gap in the previous research, raising a question about it, or extending previous knowledge in some way. (*obligatory*)
Move 3	Occupying the niche
	a. by outlining purposes or stating the nature of the present research. (obligatory)
	b. by announcing principal findings. *(optional)*
	c. by indicating the structure of the research paper. *(optional)*

I Introduction

MOVE 1

① The increasing interest in high-angle-of-attack aerodynamics has heightened the need for computational tools suitable to predict the flowfield and the aerodynamic coefficients in this regime. ② Of particular interest and complexity are the symmetric and the asymmetric separated vortex flows which develop about slender bodies as the angle of attack is increased. **A**

③ The viscuous influence on the separation lines and the uknown three-dimensional (3D) shape of the vortex wake are some of the main flow features that must be remodeled in the construction of a computational method to properly treat this problem. ④ Among the many potential flow methods developed in attempting to solve body vortex flows are early two-dimensional (2D) multivortex methods, [2-4] 2D time-stepping vortex models that include boundary-layer considerations, [5-8] and a quasi-3D potential flow method[9] that uses source and vortex elements. **B** ⑤ Linear, unseparated potential flow models as well as purely viscuous models, are not mentioned here. ⑥ A survey of the various methods may also be found in Ref. 10. ⑦ The potential flow methods are of special interest because of their ability to treat 3D body shapes and their separated vortex flows using a simple and relatively inexpensive model.

MOVE 2

⑧ However, the previously mentioned methods suffer from some limitations mainly concerning the treatment of the vortex wake formation and its interaction with the body. ⑨ The first group of methods [2-4] cannot treat 3D flows and is limited to very slender bodies. ⑩ The second group of computational methods is time-consuming and therefore expensive, and its separation prediction is not sufficiently accurate. ⑪ Both the methods in this group and the method in Ref. 9 suffer from the dependency on too many semiempirical inputs and assumptions concerning the vortex wake and its separation. ⑫ The steady, 3D nonlinear vortex-lattice method,[11-12] upon which the present method is based eliminates many of these limitations by introducing a more consistent model, but it can treat only symmetrical flow cases.

MOVE 3

⑬ The present work extends the use of the last model to asymmetric, body-vortex flow cases, thus increasing the range of flow problems that can be investigated. ⑭ In addition, an effort is made to improve the numerical procedure to accelerate the convergence of the iterative solution and to get a better rollup of the vortex lines representing the wake.

Almosino, D. (1985). "High angle-of-attack calculations of the subsonic vortex flow in slender bodies." *AIAA Journal 23*(8), 1150-56.

MOVE 1A
Claiming centrality

1. Indicating interest

- Recently, there has been a spate of interest in how to …
- In recent years, applied researchers have become increasingly interested in …
- The possibility that … has generated interest in the development of …
- Recently, there has been wide interest in the realization of …

2. Indicating importance

- Knowledge of a precise equation has a great importance for the description of …
- The theory that … has led to the hope that the carcino-genesis process in humans may be blocked by …
- Thus the study of these has become an important aspect of …

3. Indicating topic-prominence

- The … has been studied by many authors.
- The explication of the relationship between … is a classic problem of …
- The well-known … phenomena … have been favourite topics for analysis both in …

4. Indicating standard procedures

- One of the most popular instruments for assessing… has been the…
- … has been treated in recent years with a combination of …
- … have generally been used at … levels by combining the …

EXERCISES

Ex. 1

Read the Introduction to a research paper. Match each Step (1-7) to an extract from the text (A-F). Note! One Step is extra (put –)

.

1. Indicating a gap in the previous research
2. Outlining the purpose of the present research
3. Announcing principle findings
4. Claiming the centrality of the research area
5. Indicating the structure of the research paper
6. Listing research questions
7. Reviewing items of previous research in the area

Locally linear denoising on image manifolds

Dian Gong Fei Sha Gérard Medioni

A Many algorithms developed for tasks in computer vision, such as object recognition, segmentation and others, assume that the input images contain little or no noise. Thus, for vision systems accomplishing those tasks, it is important to remove excessive noise in imaging at processing stages as early as possible.

B Image denosing is an important preprocessing step for achieving that goal (Elad and Aharon, 2006; Buades et al., 2005; Perona and Malik, 1990). Denoising techniques are also widely used in computer graphics (Fleishman et al., 2003), digital photography (Fergus et al, 2006) and other publications. <…>

C While the majority of existing work has been focusing on denoising a single image, we investigate the problem of denoising collectively a collection of images. In many cases, latent intrinsic structures underpin those images. For instance, an imagery library of an object can be completely described with a few parameters such as the lighting condition, the camera position, etc. We assume that these latent variables lie on a smooth low dimensional manifold. Identifying image manifolds is an active research topic in manifold learning and latent variable models (Tenenbaum et al., 2000; Roweis and Saul, 2000; Belkin and Niyogy, 2003; Lawrence, 2005). We consider the problem of the problem in this context. Specifically we view images as random samples (with noise) from the manifold. A natural question arises: can the intrinsic structure be exploited for denoising? Note that the intrinsic structure is often unknown a priori, therefore needs to be inferred from the (noisy) data. How can we achieve robust denoising and inference at the same time?

D Our work investigates these questions. We propose a simple and effective procedure for denoising data on manifolds. <…>

E The rest of the paper is organized as follows. In section 2, we summarize briefly related work. We derive and describe our algorithm in section 3. Experimental evaluation is presented in section 4. We discuss future research directions in section 5.

F

ASSIGNMENT 4

4.1. Look at the **Introduction** section from your field of interest. Try to find all the three moves (**1-3**) in them.

4.2. How many begin with a **Move 1a** (*Establishing a research territory by showing that the general research area is important, central, interesting, problematic, or relevant in some way*)?

4.3. What clichés or 'skeleton phrases[1]' are used in this move?

4.4. Write **Move 1a** for your own article (1-2 sentences).

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 5. Introduction. Move 1b

Literature review

Literature review in the field of study is an obligatory element of a research article. On the one hand, it gives a general picture of the research area, on the other hand, it prepares the place for the niche. It also pays tribute to other researchers recognized in this field and thus increases the importance of our own research.

The formal indicators of the literature review are references and citations which distinguish a scientific text proper from a popular scientific text.

There are three major patterns for citing statements:

Pattern I – reference to single studies (researcher activity as an agent) – ***Past Simple***

Jones (2007) *investigated* the causes of illiteracy.
The causes of illiteracy *were investigated* by Jones (2007)

Pattern II – reference to areas of inquiry (researcher activity not as an agent) – ***Present Perfect***

The causes of illiteracy *have been* widely *investigated* (Jones 2007, Ferrara 2010, Hyon 2004).
There *have been* several investigations into the causes of illiteracy (Jones 2007, Ferrara 2010, Hyon 2004).
Several researchers *have studied* the causes of illiteracy. [1-3]

Pattern III – reference to state of current knowledge (no reference to researcher activity) – ***Present Simple***

The causes of illiteracy *are* complex (Jones 2007, Ferrara 2010, Hyon 2004).
Illiteracy *appears to have* a complex set of causes. [1-3]

In **Pattern I** and **Pattern II** attention is given to what previous researchers did, while in **Pattern III** the focus is on what has been found.

Pattern I usually makes use of ***Past Simple*** (*investigated, studied, analysed*, etc.).

Present Simple indicates that the research reported is *close* to the writer in some way: close to the writer's own opinion, to the writer's own research, or close to the current state of knowledge:

Jones (2007) concluded that illiteracy can be related to …

Jones ←----------→ Author

Jones (2007) has concluded that …

Jones ←----------→ Author

Jones (2007) concludes that …

Jones ←-----→ Author

Present Simple is also used with the famous or important sources (***Citational Present***):

Plato argues that …
Confucius says
The Constitution states …

The same tenses are used in the subordinate clauses:

Jones (2007) found that illiteracy *was* correlated most closely with poverty.
Jones (2007) found that illiteracy *is* correlated most closely with poverty.

The first sentence shows that the writer believes that the finding should be understood within the context of the single study. In the second, the writer implies that a wider generalization is possible.

INDIVIDUAL STYLES (REFERENCE SYSTEMS)

The author name style (e.g. *Harvard style*)
The first author's family name and the date of publication: (Newton, 1729)

The numerical style (e.g. **Vancouver** style used by IEEE)
The numbers in square brackets that appear sequentially through the paper: [1]. **!** Do not use "Ref. [3]" of reference [3]" except at the beginning of a sentence: "Reference [3] was the first …"

LANGUAGE FEATURES

Reported speech

- **Direct speech:**

  [Dr. Hardin B. Jones:] "Chemotherapy fails to work 97% of the time".

- **Reported (Indirect) speech:**

  Dr. Hardin B. Jones argues that chemotherapy fails to work 97% of the time.

Reporting Verbs

analyze	argue	claim	conclude
demonstrate	describe	develop	discuss
examine	expand	find	focus
give	investigate	note	observe
opine	point out	propose	provide
report	say	show	state
study	suggest	use	present

Tense forms

- **Present Simple** – indicates an established scientific fact
- **Past Simple** – indicates what was found in the past
- **Present Perfect** – indicates connection to the present

EXERCISES

Ex. 1

There are a large number of theories about the role and purpose of citations in academic texts. Six are given below. Discuss with a group the validity of each. Which do you think contributes most to our understanding of why citations are used in academic writing?

1. This theory is widely proposed in manuals and standard practice guides.

   Citations are used to recognize and acknowledge the intellectual property rights of authors. They are a matter of ethics and a defense against plagiarism.

2. This theory also has many supporters, especially in well-established fields like the sciences.

   Citations are used to show respect to previous scholars. They recognize the history of the field by acknowledging previous achievements.

3. Ravetz (1971):

   Citations operate as a kind of mutual reward system. Rather than pay other authors money for their contributions, writers "pay" them in citations.

4. Gilbert (1977):

   Citations are tools of persuasion; writers use citations to give their statements greater authority.

5. Bavelas (1978):

   Citations are used to supply evidence that the author qualifies as a member of the chosen scholarly community; citations are used to demonstrate familiarity with the field.

6. Swales (1990):

   Citations are used to create a research space for the citing author. By describing what has been done, citations point the way to what has not been done and so prepare a space for new research.

Ex. 2

Now suppose that we have actually carried out a study of the reasons for using citations in academic texts and have begun to write a research paper. This is the draft of the Introduction so far. Read it and consider the questions that follow.

(1) Citations are widely recognized as being an important and distinctive property of academic texts. (2) Indeed, the presence or absence of citations allows the casual reader to get an immediate sense of whether a text is an "academic" or "popular" one. (3) Because citation is such an obvious surface phenomenon, it has been much discussed in the academic world. (4) Indeed, there are several theories about the role and purpose of citations in academic texts.

1) How can we sequence our six theories (plus any others)? The key element in literature reviews is that *order* is imposed on the material, not so much order in your mind, but order in the reader's mind.
2) Cleary we need to start with the two major traditional views (theories 1 and 2). How can we order the remaining four theories (3-6)?
3) Should we organize in the chronological order as presented? Is this – at least in this case – a weak kind of ordering? Is there another way?
4) One possibility might be to *categorize* theories 3-6. Do you consider the theories by Ravetz, Gilbert, Bavelas, and Swales to be economic theories? Sociological theories? Rhetorical theories?

We could then decide to take next the case where we have two member in the category. One plan could look like this.

Theory 1 Theory 2	Established major theories

Rhetorical	Theories 4 and 6	Theories associated with individual authors
Economic	Theory 3	
Sociological	Theory 5	

Read a short review of the citation literature based on the plan above.

(5)Two of these theories are widely known and generally accepted. (6)One suggests that the role of citations is to acknowledge the intellectual property of previous authors. (7)This theory, of course, underpins the concept of plagiarism, that is, the unacknowledged use of the ideas/words of others. (8)The other major theory suggests that citations function as a means of recognizing earlier achievements and thus show respect to previous researchers. (9)However, over the last 35 years, several alternative explanations for the use of citations have been proposed. (10)There are, for example, at least two theories that are overtly rhetorical. (11)Gilbert (1977) argues that citations are used to give statements greater authority, while Swales (1990) suggests that citations often operate to indicate what has not been done, thus creating space for the citing author. (12)In contrast, a sociological explanation is proposed by Bavelas (1978). (13)She argues that using citations enables an author to show that he or she is a member of the target scholarly community. (14)Perhaps the most unusual of all these newer theories is Ravetz's proposal (1971) that citations are an economic exchange system whereby authors "pay" for what they have learned by citing the source of that knowledge.

ASSIGNMENT 5

5.1. Look at **Move 1b** in the articles from your field of interest. Which patterns (**1-3**) are used?

5.2. Are there any other patterns?

5.3. What clichés or 'skeleton phrases[1]' are used in this move?

5.4. What reporting verbs are used?

5.5. Write **Move 1b** for your own article (5-10 sentences).

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 6. Introduction. Move 2

Establishing a Niche

Move 2 is the key move of the **Introduction**. It acts as a hinge that connects **Move 1** (what has been done) to **Move 3** (what the present research is about). **Move 2** thus establishes the motivation for the study. By the end of **Move 2**, the reader should have a good idea of what is going to come in **Move 3**.

Most **Move 2**s establish a niche by ***indicating a gap*** – by showing that the research story so far is not yet complete, they function as a mini-critique.
The most common strategies to indicate a gap:

A. NEGATION

1. Negative subject

Little / few

Uncountable: However, little information …
little attention …
little work …
little data …
little research …

Countable: However, few studies …
few investigations …
few researchers …
few attempts …

Note the difference in the following pairs:

There is ***little*** research.	*(negative, i.e. not enough)*
There is ***a little*** research.	*(neutral, i.e. maybe enough)*
The department has ***few*** computers.	*(negative, i.e. not enough)*
The department has ***a few*** computers.	*(neutral, i.e. maybe enough)*

No / none of

No studies / data / calculations …
None of these studies / data / calculations …

2. Negative Verbs

Here are some "negative" verbs. Working with a partner, decide how "negative" they are. Mark them as definitely or strongly negative (- -) or neutral or slightly negative (-).

However, previous research in this field has …

a. concentrated on …
b. disregarded …
c. failed to consider …
d. ignored
e. been limited …
f. misinterpreted
g. neglected to consider …
h. overestimated …
i. overlooked …
j. been restricted to …
k. suffered from …
l. underestimated …

3. Negative Adjectives

Mark these adjectives as definitely or strongly negative (- -) or neutral or slightly negative (-).

Nevertheless, these attempts to … are at present …

a. controversial
b. incomplete
c. inconclusive
d. questionable
e. unconvincing
f. unsatisfactory

B. CONTRAST

To avoid negative comment, use a contrastive statement:

The research has tended to focus on …, rather than on …

These studies have emphasized …, as opposed to …

Although considerable research has been devoted to …, rather less attention has been paid to …

C. RAISING A QUESTION, A HYPOTHESIS, OR A NEED

However, it remains unclear whether …

It would thus be of interest to learn how …

If these results could be confirmed, they would provide strong evidence for …

The findings suggest that this approach might be less effective when …

It would seem, therefore, that further investigations are needed in order to …

D. EXTENDING PREVIOUS KNOWLEDGE

These recent developments in … clearly have considerable potential. In this paper, we demonstrate …

The literature shows that … is a useful technique for … . This paper uses … to …

Such … eliminate the need for any … . This paper utilizes the N approach for …

EXERCISES

Ex. 1

Read the middle section of the introduction to a research article and answer the questions that follow.

MOVE 2

❻However, the previously mentioned methods suffer from some limitations mainly concerning the treatment of the vortex wake formation and its interaction with the body. ❼The first group of methods[2-4] cannot treat 3D flows and is limited to very slender bodies. ❽The second group of computational methods[5-8] is time consuming and therefore expensive, and its separation prediction is not sufficiently accurate. ❾Both the methods in this group and the method in [9] suffer from the dependency on too many semi-empirical inputs and assumptions concerning the vortex wake and its separation. ❿The steady 3D nonlinear vortex-lattice method, upon which the present method is based, eliminates many of these limitations by introducing a more consistent model, but it can treat only symmetrical flow cases.

1. How many "critique" expressions can you find in the passage? Underline or highlight them.
2. Look back at Task 1. What negative ratings would you give them?
3. What word signals that Move 1 has ended and Move 2 has started? What other words or expressions could also indicate this shift?
4. This Move 2 occupies as many as five sentences. Why do you think the author has put these sentences in this particular order?
5. Can you now anticipate what the next sentence is going to be?

ASSIGNMENT 6

6.1. Analyze **Move 2** in the articles from your field of interest. Which strategies are used there?

6.2. What "critique" words or expressions are used?

6.3. What clichés or 'skeleton phrases[1]' are used in this move?

6.5. Write **Move 2** for your own article (2 sentences).

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 7. Introduction. Move 3

Occupying the Niche

Move 3 makes an offer to fill the gap (or extend the tradition) that has been created in **Move 2**.

It consists of three steps:

a. outlining purposes or stating the nature of the present research. (*obligatory*)
b. listing research questions or hypotheses
c. announcing principal findings. (*optional*)
d. stating the value of the present research (*optional*)
e. indicating the structure of the research paper. (*optional*)

The first element (Move 3a) is obligatory. It has two main variants:

Purposive (P) – The author or authors indicate their main purpose or purposes

Descriptive (D) – The author or authors describe the main feature of their research

LANGUAGE FEATURES

IMPERSONAL/PERSONAL STYLE

Move 3 is typically signalled by some reference to the present text, such as the uses of *this, the present, reported*, and *here*. If the conventions of the field or journal allow it, it is also common for the authors to switch from the impersonal to the personal by using *we* or (more rarely) *I*. These signals come early in the sentence:

In this paper we present the results of three experiments.

TENSE AND PURPOSE STATEMENT

- if you refer to the ***type of text*** (paper, article, thesis, report, etc.), you must use the *Present tense*. (If you write, "The aim of this paper was to …", it suggests that you are referring to an original aim that has now changed)
- if you refer to the ***type of investigation*** (experiment, investigation, study, survey, etc.), you can use either *was* or *is* (however, there is a tendency to choose the present).

Sometimes a second sentence is necessary to complete **Move 3a**. These secondary statements are often introduced by such languages as:

In addition, … .
Additionally, … .
A secondary aim … .
A further reason for … .

Move 3b can include research questions and hypotheses:

Specifically, we test two hypotheses:
Hypothesis 1 …
Hypothesis 2 …

INFINITIVE AND GERUND

For stating the purpose of the article, an **infinitive** (*The aims of the present study were <u>to validate</u> …*) or a **Gerund** (*… aims at <u>reducing</u>…*) are used.

If we list several aims, the form should be consistent – either an infinitive, or a gerund (or a noun).

OUTLINING THE STRUCTURE OF THE TEXT

Move 3e (explaining how your text is organised) is obligatory in dissertations and theses but is only included in research papers if your text is using a standard IMRD format or is unusual in some way.

EXERCISES

Ex. 1

Here are the beginnings of ten opening Move 3 sentences. Decide in each case whether they are purposive (P) or descriptive (D).

P 1. The aim of the present paper is to give … .
D 2. This paper reports on the results obtained … .
___ 3. In this paper we give preliminary results for … .
___ 4. The main purpose of the experiment reported here was to … .
___ 5. This study was designed to evaluate … .
___ 6. The present work extends the use of the last model by … .
___ 7. We now report the interaction between … .
___ 8. The primary focus of this paper is on … .
___ 9. The aim of this investigation was to test … .
___ 10. Our primary objective was to test … .

Ex. 2

Here is an example of a textual outline. Notice how it uses different sentence structures.

The plan of this paper is as follows. Section II describes the current arrangement for regulating exchange rates within the EC. In Section III a theoretical model is constructed which is designed to capture these arrangements. Experimental parameters are then tested in Section IV. Finally, Section V offers some suggestions for the modification of the current mechanism.

Below is another textual outline written by a student. This time it lacks variety. Can you rewrite it?

The rest of the paper is organised as follows. Section 2 presents the theoretical concept. Section 3 presents the empirical specification, the implementation of the model. Section 4 presents the results of statistical and other computational analyses. Section 5 summarises the findings and provides a brief discussion concerning the shortcomings of the methods employed. Finally, an appendix presenting the detailed algebraic works is presented at the end of the paper.

Ex. 3

In the following text, the author uses various verb forms to state the purpose of the article. Rewrite the text using consistent forms.

The aim of the research is revealing specific features of the mechanical torque, determination of the magnitude of a domain of activity of the torque and to find methods for measuring of the torque.

ASSIGNMENT 7

7.1. Analyze **Move 3** in the articles from your field of interest.

7.2. Which steps (**Move 3a, Move 3b, Move 3c, Move 3d, Move 3e**) are used?

7.3. What clichés or 'skeleton phrases[1]' are used in this move?

7.4. Write **Move 3** for your own article (2-3 sentences).

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 8. Discussion

Discussion (or – for some fields or journals – **Conclusion**) is not so easy to provide guidelines for. This section is different in various research fields.

If **Results** deal with *facts*, the **Discussions** deal with *points*. Facts are *descriptive*, while points are *interpretive*.
Discussions should be more than summaries, they should go beyond the results and be:

more theoretical
or
more abstract
or
more general
or
more integrated with the field
or
more connected to the real world
or
more concerned with implications or applications

→ AND, if possible, some combination of these

Discussion Moves

Move 1	Points to consolidate your research space. (*obligatory*)
Move 2	Points to indicate the limitations of your study. (*optional but common*)
Move 3	Points to recommend a course of action and/or to identify useful areas of further research. (*optional and only common in some areas*)

Move 1 is usually quite extensive, and Moves 2 and 3 are often quite short.

Opening a Discussion Section

Move 1a	Report your accomplishments by highlighting major findings.
Move 1b	Relate and evaluate your data in the light of previous research.
Move 1c	Interpret your data by making suggestions as to why your results are the way they are.
Move 1d	Anticipate and deal with potential criticism (only if necessary)

LANGUAGE FEATURES

LEVELS OF GENERALISATION

In the **Results** sections, statements may be quite specific and closely tied to the data:

As can be seen in Table 1, 84% of the students performed above the 12th-grade level.

Seven out of eight experimental samples resisted corrosion longer than the controls.

On the other hand, in the **Abstract** or in a **Summary**, space restrictions may lead to a high level of generality:

The results indicate that the students performed above the 12th-grade level.

The experimental samples resisted corrosion longer than the controls.

In the **Discussion**, we usually expect something in between these two levels. One common device is to use one of the following "phrases of generality":

Overall, … .
In general, … .
On the whole … .
In the main … .
With … exception(s), … .
The overall results indicate … .
The results indicate, overall, that … .
In general, the experimental samples … .
With one exception, the experimental samples … .

NEXT STEPS FOR THE FIELD

Move 3 contains recommendations on a course of action and/or identifies useful areas of further research.

If you are writing about your own further research, use *will*:

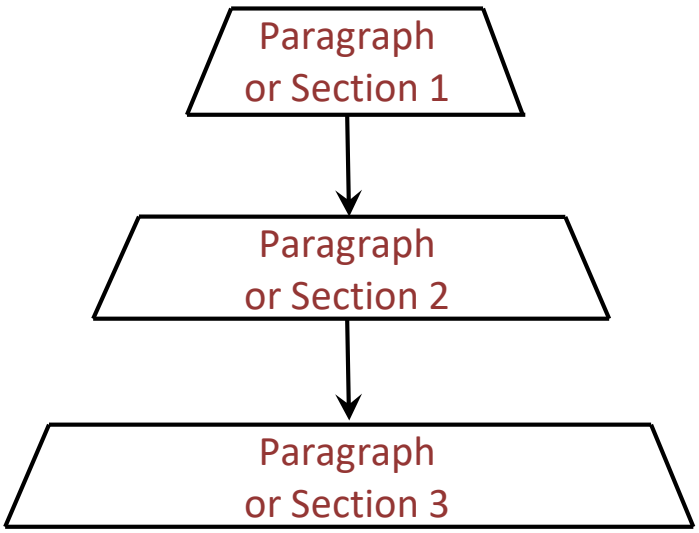
> Future work ***will*** be undoubtedly done to deal with the parameterization issue of our approach.

If you are writing about other researchers may study, use *should*:

> While actual bodies are not exactly uniform and ellipsoidal, the entirety of solutions for all possible ellipsoidal shapes presented **should** furnish a good guide to the permissible spins of actual bodies.

CYCLES OF MOVES

Many **Discussion** sections run through the **Move 1-2-3** sequence (or part of it) more than once.
Commonly, each cycle occupies one paragraph.
To write a longer discussion, follow the shape recommended below:



SELF-ASSESSMENT

You can use these questions to help you with your **Discussion** section

1. Do my data support what I set out to demonstrate at the beginning of the paper?
2. How do my findings compare with what others have found? How consistent are they?
3. What is my personal interpretation of my findings?
4. What other possible interpretations are there?
5. What are the limitations of my study? What other factors could have influenced my findings? Have I reported everything that could make my findings invalid?
6. Do any of the interpretations reveal a possible flaw (i.e. defect, error) in my experiment?
7. Do my interpretations contribute some new understanding of the problem that I have investigated? In which case do they suggest a shortcoming in, or an advance on, the work of others?
8. What external validity do my findings have? How could my findings be generalized to other areas?
9. What possible implications or applications do my findings have? What support can I give for such implications?
10. What further research would be needed to explain the issues raised by my findings? Will I do this research myself or do I want to throw it open to the community?

EXERCISES

Ex. 1

Read the opening and the closing paragraphs of the first Discussion subsection and answer the questions that follow.

❶ This interview study indicates that hospitalized children, aged 8-12 yr old, are capable of describing the methods for relieving pain. ❷ The results are consistent with earlier studies conducted among pediatric patients (Savedra et al. 1982; Pölkki et al. 1999; Pederson et al. 2000). ❸ In order to achieve the children's own perspective, however, the children should be asked about the methods that could potentially alleviate their pain, as well as their suggestions regarding the implementation of pain relief measures. ❹ Due to their tendency to be independent, school-aged children may conceal their pain and be reluctant to request help from others (cf. Lutz, 1986; Woodgate and Kristijanson, 1995). ❺ This phenomenon in the children requires specific attention, despite the fact that a certain level of cognitive maturity is achieved during the school-aged period, and a much broader array of non-pharmacological methods are appropriate to use at this age (Vessey and Carlson, 1996) … .

❻ Many children had suggestions to the nurses, but only a few to the parents concerning the implementation of surgical pain relief measures. ❼ This may indicate that the children expect the nurses to know how to care for them and relieve their pain (cf. Alex and Ritchie, 1992), whereas the children do not have specific expectations of their parents other than simply to "stay with me more." ❽ In order to improve nursing care for children with postoperative pain the recommendations provided by children to nurses, such as creating a more comfortable environment (especially minimizing noise problems), giving more of stronger pain medication without delay, as well as visiting regularly or staying with the child more, should be taken seriously into account in nursing practice.

1. How many of the eight sentences make reference to the previous literature?
2. What does *cf.* mean?
3. What do you think are the purposes of sentences 3-5?
4. What do you think were the topics of the two missing paragraphs (paragraphs 2 and 3)?
5. The discussion has three titled subsections. The second is called "Reliability and Validity", and the third "Challenges for Future Research". What do you think the first subsection was called?

ASSIGNMENT 8

8.1. Analyze the **Discussion** section in the articles from your field of interest.

8.2. Which **Moves (1-3)** and steps (**Move 1a – Move 1d**) are used?

8.3. What clichés or 'skeleton phrases[1]' are used in this section?

8.4. Write the **Discussion** section for your own article (10-12 sentences).

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Unit 9. References

LIST OF REFERENCES VS BIBLIOGRAPHY

List of References:

- every reference is cited in the main text
- every citation in the main text has a full and proper reference in the reference list

Bibliography:

- a list of papers consulted to develop an argument but not referenced individually in the text
- used for teaching (not for research papers)

REFERENCE LIST

Inadequate

- < 10 papers

Not highly regarded

- only the very recent work
- written by the authors themselves

REFERENCING STYLES

- author date style (e.g. **Harvard** reference style)
- numerical style (e.g. **Vancouver** reference style used by **IEEE**)

Harvard

- a generic term for any style which contains author-date references in the text of the document, such as (Smith 1999).
- there is no official manual of the Harvard style: it is just a generic term for the many styles which follow that format.

APA (American Psychological Association)

the standard style used in Psychology, but it is also widely used in other disciplines, especially in the Social Sciences. It is one of the many variants of the Harvard style.

AMA (American Medical Association)

is used in medicine

MLA (Modern Language Association of America)

is used in the fields of modern literature and linguistics

Vancouver

- is a generic term for a style of referencing using a numbered reference list.
- There is no official manual of the Vancouver style

IEEE (Institute of Electrical and Electronics Engineers)

- is the major professional body and publisher in the fields of electrical engineering and computer science. Their style manual is widely used in those disciplines. It uses a numbered reference list.
- The **IEEE Computer Society** has its own style manual, which is based on the IEEE manual but differs in some respects.

STYLE MANUALS

Chicago Manual of Style

is the most widely consulted of all style manuals. It includes provisions for footnote referencing and author-date referencing. It is widely used in the arts and humanities.

CSE (Council of Science Editors)

It was first issued in 1960 by the Council of Biology Editors and is still sometimes referred to as the CBE manual.

It is widely used in the life sciences, and its provisions are applicable to other scientific disciplines.

Author Date Style

- in the *main text*: the first author family name and the date of publication

  (Newton, 1729)

- in the *reference list*: the authors are listed alphabetically
- repeated author names listed in order of publication date
- if the author has two publications with the same date, they are referred to as *Yeara* and then *Yearb*:

  (Newton 1729a and Newton 1729b)

Numerical Style

- in the *main text*: the number appear sequentially through the paper by square brackets, e.g. [1]
- in the *reference list*: references are listed in the order they are mentioned in the text
- if a reference is used more than once, the same number is used and only one entry is given in the reference list

HARVARD STYLE

BOOK

Author's Surname, INITIALS., Year of publication. *Title* [online] (if applicable). Edition (if not the first edition). Place of publication: Publisher.

Print book

e.g. Cottrell, S., 2013. *The study skills handbook*. 4th edition. Hampshire: Palgrave.

E-book

e.g. McMillan, K. and Weyers, J., 2012. *The study skills book* [online]. 3rd edition. Harlow: Pearson.

Contribution in an edited book e.g. a chapter

Contributing author's Surname, INITIALS., Year of publication. Title of contribution. Followed by *In*: Surname, INITIALS., of author or editor of publication followed by ed. or eds. if appropriate. (Year of publication, if different to contribution). *Title of book* [online] (if applicable). Edition (if not the first edition). Place of publication: Publisher, Page number(s) of contribution.

e.g. Harris, J., 1985. The value of life. *In:* Kuhse, H. and Singer, P., eds. 2005. *Bioethics: an anthology* [online]. 2nd edition. Oxford: Blackwell, 428-436.

JOURNAL

Article in a print or online journal

Author's Surname, INITIALS., Year of publication. Title of article. *Title of journal* [online] (if applicable), Volume number and (part number), Page numbers of article (if available).

e.g. Kavaratzis, M. and Hatch, M. J., 2013. The dynamics of place brands: an identity-based approach to place branding theory. *Marketing theory*, 13 (1), 69-86.

e.g. Brooks, R., Waters, J. and Pimlott-Wilson, H., 2012. International education and the employability of UK students. *British educational research journal* [online], 38 (2), 281-298.

Article in an online journal described as 'In Press'

For articles that are described as 'In Press' you must include the full URL, as the article has not be assigned a precise volume and issue number:

e.g. Pisanua, B., Chapuisa, J., Dozièresa, A., Basset, F., Poux, V. and Vourc, G., 2013. High prevalence of Borrelia burgdorferi s.l. in the European red squirrel Sciurus vulgaris in France. *Ticks and tick-borne diseases* [online], In Press. Available from: https://www.sciencedirect.com/science/article/pii/S1877959X13000800 [Accessed 9 November 2013].

CONFERENCE

Conference paper or proceeding

Author's Surname, INITIALS., Year of publication. Title of contribution [online] (if applicable). Followed by *In*: Surname, INITIALS., of editor of proceedings (if applicable) followed by ed. or eds. if relevant. *Title of conference*, including place and date of conference. Place of publication: Publisher. Page numbers of contribution. Available from: URL [Accessed Date] (if applicable).

e.g. Flintham, J., 2011. Narrative approaches to wellbeing [online]. *In:* Coles, R., Millman, Z., Collins, J. and Stint, C., eds. *Well-being 2011 - the first international conference exploring the multi-dimensions of well-being,* Birmingham 18-19 July 2011. Birmingham: Birmingham City University and the Royal Institute of British Architects (RIBA). Available from: http://www.biad.bcu.ac.uk/research/wellbeing2011 [Accessed 9 July 2013].

THESIS

Author's Surname, INITIALS., Year of publication. *Title of thesis* [online] (if applicable). Designation (and type). Name of institution to which submitted.

e.g. Klinkner, M. J., 2009. Toward improved understanding and interaction between forensic science and international criminal law in the context of transitional justice [online]. Thesis (PhD). Bournemouth University.

STANDARDS

Organisation, Year of publication. *Standard number and title* [online] (if applicable). Place of publication: Publisher.

e.g. British Standards Institution, 2010. *BS ISO 690:2010 Information and documentation – Guidelines for bibliographic references and citations to information resources* [online]. London: British Standards Institution Group.

PATENTS

Originator, (name of applicant/s), Year of publication. *Title of patent* [online] (if applicable). Series designation / number (which may include full date).

e.g. Philip Morris Inc., 1981. *Optical perforating apparatus and system.* European patent application 0021165 A1. 1 July 1981.

IEEE Citation Reference

BOOKS

Basic Format:

[1] J. K. Author, "Title of chapter in the book," in *Title of His Published Book, x*th ed. City of Publisher, Country if not USA: Abbrev. of Publisher, year, ch. *x*, sec. *x*, pp. *xxx–xxx.*

Examples:

[1] B. Klaus and P. Horn, *Robot Vision.* Cambridge, MA: MIT Press, 1986.

[2] L. Stein, "Random patterns," in *Computers and You,* J. S. Brake, Ed. New York: Wiley, 1994, pp. 55-70.

[3] R. L. Myer, "Parametric oscillators and nonlinear materials," in *Nonlinear Optics*, vol. 4, P. G. Harper and B. S. Wherret, Eds. San Francisco, CA: Academic, 1977, pp. 47-160.

[4] M. Abramowitz and I. A. Stegun, Eds., *Handbook of Mathematical Functions* (Applied Mathematics Series 55). Washington, DC: NBS, 1964, pp. 32-33.

[5] E. F. Moore, "Gedanken-experiments on sequential machines," in *Automata Studies* (Ann. of Mathematical Studies, no. 1), C. E. Shannon and J. McCarthy, Eds. Princeton, NJ: Princeton Univ. Press, 1965, pp. 129-153.

[6] Westinghouse Electric Corporation (Staff of Technology and Science, Aerospace Div.), *Integrated Electronic Systems*. Englewood Cliffs, NJ: Prentice-Hall, 1970.

[7] M. Gorkii, "Optimal design," *Dokl. Akad. Nauk SSSR*, vol. 12, pp. 111-122, 1961 (Transl.: in L. Pontryagin, Ed., *The Mathematical Theory of Optimal Processes.* New York: Interscience, 1962, ch. 2, sec. 3, pp. 127-135).

[8] G. O. Young, "Synthetic structure of industrial plastics," in *Plastics,* vol. 3, *Polymers of Hexadromicon*, J. Peters, Ed., 2nd ed. New York: McGraw-Hill, 1964, pp. 15-64.

ONLINE BIBLIOGRAPHY GENERATORS

http://www.harvardgenerator.com/
http://www.easybib.com/http://www.easybib.com/
http://www.classtools.net/citation-generator/

Computer programmes that can help in

- maintaining a reference list
- extracting references for inclusion in a publication in the required style
  - EndNote
  - ProCite
  - RefMan
  - JabRef
  - BibTeX

Always read the '*Instructions for Authors*' for journals and conferences.

ASSIGNMENT 9

Make a **Reference List** for your own article.

Use the Harvard Style (or IEEE style) depending on your research field. Your list should include the following:

9.1. A book by one author.

9.2. A book by several authors.

9.3. A contribution in an edited book e.g. a chapter.

9.4. A journal article in a print or online journal.

Unit 10. Titles

Although the title comes FIRST in a research paper, it may sometimes be written LAST because it is very important.

The title should:

- indicate the **topic** of the study
- indicate the **scope** of the study (i.e. neither overestimating nor underestimating its significance)
- be **self-explanatory** to readers in the chosen area

Types of titles

- **Declarative** – state the main findings or conclusions

  'A three-month weight loss program increases self-esteem in adolescent girls'
- **Descriptive** – describe the subject of the article but do not reveal the main conclusions

  'The effects of family support on patients with dementia'
- **Interrogative** – introduce the subject in the form of a question

  'Does cognitive training improve performance on pattern recognition tasks?'

Title Analysis

High Angle-of-Attack Calculations of the Sub-sonic Vortex Flow in Slender Bodies (Almosnino, p. 250)

Title	Number of words	Any verbs	Punctuation	Field
1	11	No	No	Aerospace engineering

Length

In some areas (the life sciences), titles are becoming longer and looking like full sentences.

In others, the preferred style is for short titles containing mostly nouns and prepositions.

The recommended length of a title is no more than 12 words (APA, 2009).

Language

Articles

Sometimes the rules of articles are not observed (this varies from field to field):

Global Implications of Patent Law Variation

Noun-phrases

Cultural heritage audiovisual material multilingual search gathering requirements. ✘

Gathering requirements for multilingual searches for audiovisual materials in the cultural heritage. ✓

Of-phrases

Optimization **of** control **of** guaranteed search **of** moving object on plane ✘

Capitalization

- **Title case** – capitalize the important words in the title

  'A Three-Month Weight Loss Program Increases Self-Esteem in Adolescent Girls'

- **Sentence case** – only the first word and proper nouns in the title are capitalized

  'A three-month weight loss program increases self-esteem in adolescent girls'

The following groups of auxiliary words are not capitalized

- **articles** (*a, an, the*),
- **prepositions** (*against, between, in, of, to*),
- **conjunctions** (*and, but, for, nor, or, so, yet*),
- **infinitive particle** *to*.

Always capitalize:

- the first word,
- the first word after a colon or a dash.

Colon

Colons are widely used in titles:

Dialectics of resilience: A multi-level analysis of a telehealth innovation

Security issues in cloud environments: A survey

Its main function is to separate the ideas in the following combinations:

Pre-Colon	Post-Colon
Problem:	Solution
General:	Specific
Topic:	Method
Major:	Minor

Qualifications

Words or phrases that moderate, soften, of qualify the claims:

1a. On Big Data Benchmarking
1b. Big Data Benchmarking
2a. A Study of Research Article Results Sections
2b. A Preliminary Study of Research Article Results Sections
3a. An Analysis of Errors in Period Placement

3b. Toward an Analysis of Errors in Period Placement
4a. The Role of Urban Planners
4b. The Potential Role of Urban Planners
4c. A Possible Role for Urban Planners

Qualifications can also be helpful in making the title more specific.

TIPS

Do not use acronyms in the title without spelling them out.
Avoid "clever", "joke", or "trick" titles.

ASSIGNMENT 10

10.1. Use the Table "Title Analysis" to analyze the titles of the articles from your field.

10.2. Are they declarative, descriptive or interrogative?

10.3. Do they use colons? What are the functions of the colons?

10.4. What type of capitalization is used: title case or sentence case?

10.5. Are there any qualifications? What is their function?

10.6. Are the article rules observed?

10.7. Write a title to your article.

Unit 11. Key words

Keywords are a tool to help indexers and search engines find relevant papers. If database search engines can find your journal manuscript, readers will be able to find it too. This will increase the number of people reading your manuscript, and likely lead to more citations.

However, to be effective, keywords must be chosen carefully. They should:

- Represent the content of your manuscript
- Be specific to your field or sub-field

Examples:

Title:

Direct observation of nonlinear optics in an isolated carbon nanotube

Poor keywords:

molecule, optics, lasers, energy lifetime

Better keywords:

single-molecule interaction, Kerr effect, carbon nanotubes, energy level structure

or

Title:

Region-specific neuronal degeneration after okadaic acid administration

Poor keywords:

neuron, brain, OA (an abbreviation), regional-specific neuronal degeneration, signaling

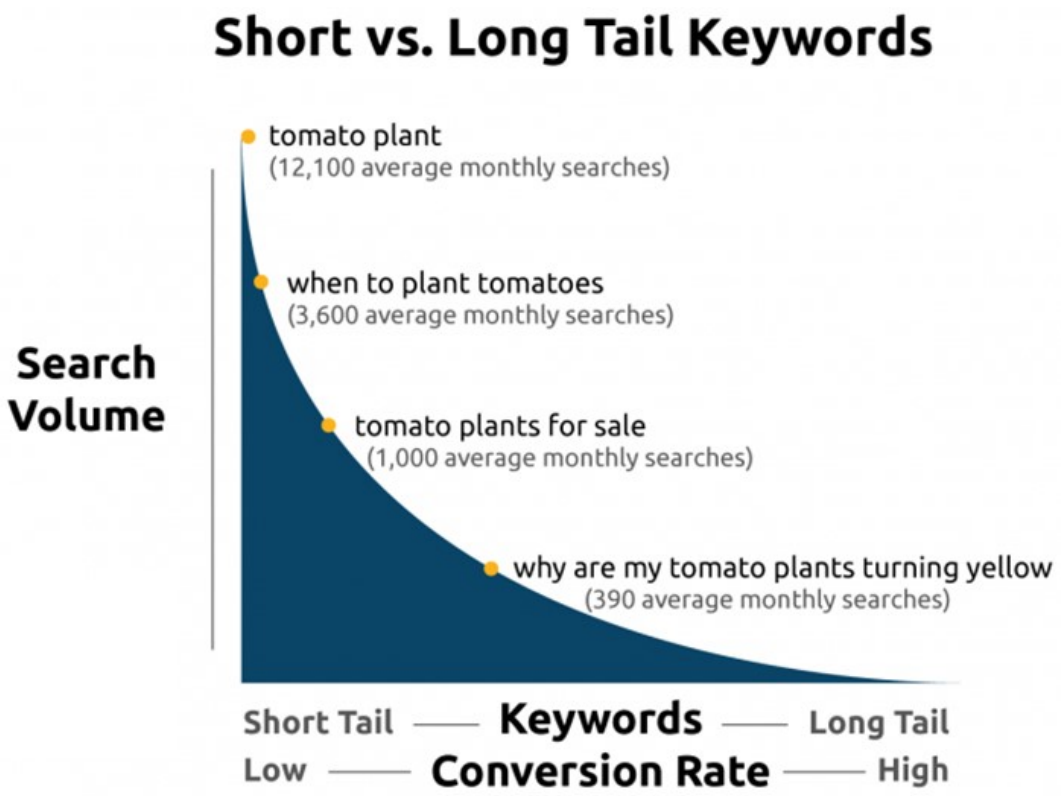
Better keywords:

neurodegenerative diseases; CA1 region, hippocampal; okadaic acid; neurotoxins; MAP kinase signaling system; cell death

Tips on chosing the keywords:

- Read through your paper and list down the terms/phrases that are used repeatedly in the text.
- Choose about 6 words that will enhance the possibility of the paper being retrieved
- Refer to main topic
- Refer to main result

- Refer to main method
- Contain the vital word in the title (*some journals*)
- Do not use words or phrases from the title (*some journals*)
- Ensure that this list includes all your main key terms/phrases and a few additional key phrases
- Include variants of a term/phrase
- Include ONLY common abbreviations of terms (e.g., HIV)
- Refer to a common vocabulary/term list or indexing standard in your discipline and ensure that the terms you have used match those used in these resources.
- 'Long tail' keywords are advised



- Type your keywords into an engine and check if the results that show up match the subject of your paper.
- **Always read the "*Instructions for Authors*"**

ASSIGNMENT 11

11.1. Read the requirements for the key words in a journal in your research field.

11.2. Make a list of key words for your article.

11.3. Search them on the Internet and check if the results match up with your subject.

11.4. Correct your list of key words if necessary.

Unit 12. Abstract

"A brief, but total, summary of the research reported"

- Abstracts were only introduced into medical research articles during the 1960s
- The now-fashionable "**structured**" abstracts did not appear until about **1987**
- **several million** of research papers are published every year (Swales and Feak, 2009)
- SCOPUS, lists **16,000** peer reviewed journals and supplements 600 new publications each year
- Among some top journals manuscripts may be **rejected** after reading of the **abstract** alone

Functions

- stand-alone **mini-texts**, giving readers a short summary of a study's topic, methodology and main findings;
- **screening devices**, helping readers decide whether they wish to read the whole article or not;
- **previews** for readers intending to read the whole article, giving them a road-map for their reading;
- **indexing** help for professional abstract writers and editors.

Types of abstracts

- **Indicative abstracts** lay out what will be done in the paper (like as a Table of Contents);
- **Informative** (result-driven) **abstracts** summarize the main findings (and probably have a background statement, and possibly something about methods)

Types of abstracts

- **Structured abstracts** (with named subsections)
- **Unstructured abstracts** (without named subsections)

Structured Abstract

J J Turner and K Wilson (2006) 'Grocery loyalty: Tesco Clubcard and its impact on loyalty', **British Food Journal,** vol. 108 (11), pp. 958-964

Purpose – The aim of the research is to identify the impact of the Tesco Clubcard on customer loyalty. The secondary aim is to contrast customer perceptions of the Clubcard, staff and "feeling valued" to identify which factor has the greater impact on customer loyalty to store.

Design/methodology/approach – Quantitative analysis was used based on 60 questionnaires conducted with randomly selected customers in Tesco Metro Dundee in 2005. Tesco were not involved in the research other than to provide approval at a store level for the research to take place outside their premises.

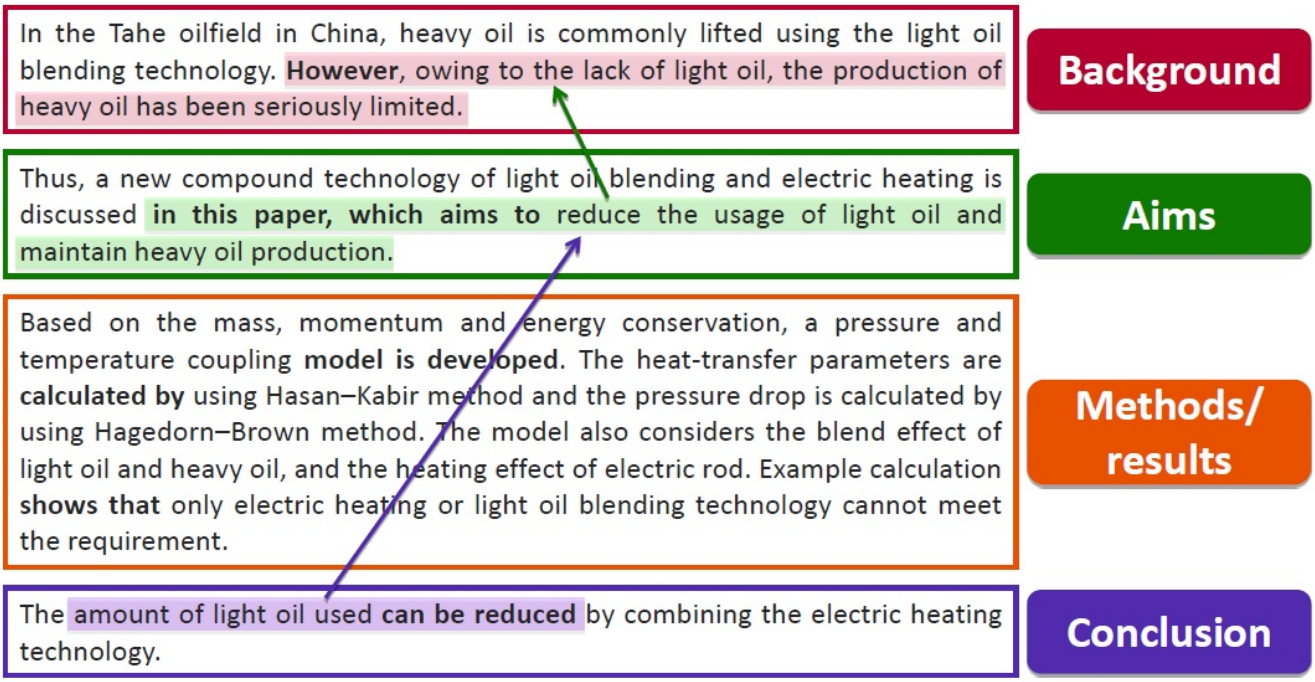
Findings – A positive moderate relationship was found r=0.388, p=0.01 between the owning of a Clubcard and loyalty to store. It was also found that there was a positive moderate relationship between the Clubcard returns and customer loyalty, with r=0.334, p=0.01. The research, however, found no relationship between loyalty and customers feeling more valued by Tesco, nor did the research reveal a significant relationship between Tesco staff and customer loyalty.

Research limitations/implications – The research is restricted in so far as it only considers Tesco Clubcard in the grocery retail sector and as it is an exploratory study the research is limited in so far as the number of participants is only 60. A further limitation surrounds the issue of generalisability as only one Tesco retail outlet in Dundee was used. Further research needs to include other Tesco formats and contrast with grocery retailers who do not use loyalty cards.

Practical implications – It is suggested that Tesco consumers are influenced by having a loyalty card in so far as it contributes to making them loyal. However, other factors need to compliment such a card, with consumers seeing the Tesco "provision" as inter-related.

Originality/value – The paper is useful to both practitioners and academics in the fields of relationship marketing and loyalty. The research provides some initial insight into consumer perspectives in the value of loyalty cards.

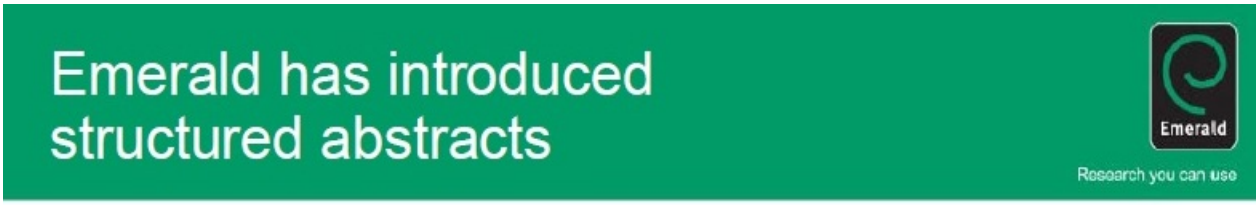
Unstructured Abstract



Length

- **Unstructured abstracts** – **100-250** words (one paragraph)
- **Structured abstracts** – up to **400** words (divided into several short sections)

Structured Abstract



- **A structured abstract** – in 250 words or less (no more than 100 in any one section)
- **Purpose** – Reasons/aims of paper
- **Design** – Methodology/'how it was done'/scope of study
- **Findings** – Discussion/results
- **Research limitations/Implications** (if applicable) – Exclusions/next steps
- **Practical implications** (if applicable) – Applications to practice/'So what?'
- **[NEW] Social implications** (if applicable) – Impact on society/policy
- **Originality/value** – Who would benefit from this and what is new about it?

Unstructured Abstract

Move #	Typical labels / Implied questions
Move 1	Background/introduction/situation *- What do we know about the topic?*
Move 2	Present research/purpose *- What is this study about?*
Move 3	Methods/materials/subjects/procedures *- How was it done?*
Move 4	Results/findings *- What was discovered?*
Move 5	Discussion/conclusion/significance *- What do the findings mean?*

Opening sentence

Four types:

A. Starting with a Real-World Phenomenon or with Standard Practice

Corporate taxation rates vary around the world.
Economists have long been interested in the relationship between corporate taxation and corporate strategy.

B. Starting with Purpose or Objective

The aim of this study is to examine the effects of the recent change in corporate taxation.

C. Starting with Present Research Action

We analyze corporate taxation returns before and after the introduction of the new tax rules.

D. Starting with Problem or an Uncertainty

The relationship between corporate taxation and corporate strategy remain unclear.

Language features

1. the use of full sentences
2. the use of impersonal passive
3. the absence of negatives
4. the avoidance of abbreviations, jargon, symbols and other language shortcuts that might lead to confusion

Tenses

PRESENT SIMPLE

1. to describe the contents of the paper:
   we investigate, we show
2. to describe the common opinion that the author is trying to question:
   the phenomenon is essentially random
3. to talk about a well-known situation
   people tend to hold overly favourable views
4. to explain one's opinion on this well-known situation
   the authors suggest that …

PAST SIMPLE

1. to describe what the author did / achieved :
   we showed that…
2. to give the conclusions:
   the authors found that…

PRESENT PERFECT (OR PRESENT PERFECT CONTINUOUS)

1. to describe a situation that began in the past and is still true now (typical when you are giving the context/background):

   In the last few years there has been considerable interest in …
   Since 2010 attention has focused on …
   To date, there has not been an adequate analytical model …
   For more than a decade data analysts have been developing new ways to …

2. to describe what the authors achieved during their research :

   We have found / devised / developed a new approach to X. We have demonstrated / proved / validated the effectiveness of this approach by …
   A new approach to X has been devised. The effectiveness of the approach has been demonstrated …

Personal or Impersonal?

Four styles:

STYLE 1	I found that x=y. *(depends on the requirements of the journal, usually in humanistic fields)*
STYLE 2	We found that x=y. *(in all fields)*
STYLE 3	It was found that x=y. *(also very common, many journals insist on this style)*
STYLE 4	The authors found that x=y. *(the least common style)*

Things to avoid in abstracts

- background information that is too general for the readers
- claims that are not supported in the paper
- terms that are too technical or too generic
- definitions of key terms
- mathematical equations
- generic quantifications (e.g. *many, several, a wide variety*)
- subjective adjectives (e.g. *innovative, interesting, fundamental*)
- unnecessary details (they are better located in the Introduction)
- references to other papers (unless the whole paper is based on extending or refuting a finding given by one specific author)

EXERCISES

Ex. 1

Read the opening and the closing paragraphs of the first Discussion subsection and answer the questions that follow.

Perinatology is a medical speciality dealing with foetuses and new-borns and has a number of research journals. Some of these use structured abstracts and some continue to use unstructured ones. As a preview here is a typical unstructured abstract from this field. It has been blocked into moves for you.

① The object of this study was to evaluate postpartum women for psychiatric symptomatology including cognitive disturbances, anxiety, depression, and anger to better meet their needs for support and involve them in the care of their infants.	**Move 2**
② We interviewed 52 postpartum mothers at the Bronx Lebanon Hospital Center within 5 days of delivery and determined the presence of psychiatric symptoms using the 29-item Psychiatric Symptom Index.	**Move 3**
③ Despite the fact that adult mothers were happier they were pregnant (71.4% versus 29.4%; $p = 0.010$) and less likely to be worried about their baby's health (25.7% versus 52.9%; $p = 0.003$), adult mothers demonstrated higher depressive symptomatology ($p = 0.009$), higher amounts of anger ($p = 0.004$), and greater overall psychiatric symptomatology ($p = 0.005$) than adolescent mothers. ④ Mothers whose infants were in the neonatal intensive care unit did not report significantly higher psychiatric symptomatology than mothers whose infants were healthy.	**Move 4**
⑤ Physicians need to be aware of the high levels of depression and anger present among postpartum women so appropriate support can be given.	**Move 5**

Note: In the **Results** move, the significant findings (Sentence 3) are given before the non-significant ones (Sentence 4).

Read the following abstract and analyse it using the questions below.

❶The inherent brittleness of continuous unidirectional fibre reinforced composites is a major drawback to their otherwise outstanding mechanical performance. ❷This paper exploits composites with overlapped discontinuities at the ply level to create a significantly non-linear response, due to progressive interlaminar damage under tensile loading. ❸Two distinct configurations were manufactured with the same carbon/epoxy system and tested under quasi-static tension, showing that varying the thickness and length of the overlapping ply blocks resulted in significantly different mechanical responses and failure modes. ❹A previously developed generalised shear-lag model was successfully used to optimise the overlap configuration, and accurately predicted the response in both strength- and toughness-dominated cases. ❺This work demonstrates that unidirectional composites with well-designed discontinuities at the ply level can provide a significantly non-linear response with clear warning before failure, while retaining similar stiffness and up to 50% of the strength of their continuous counterparts.

1. What field does this abstract come from?
2. Underline what you consider to be the key clause in the abstract (the part which summarizes the main finding of the entire article).
3. What is the number of words and of sentences?
4. Which of the two abstract types is it: **Indicative abstract** (lays out what will be done in the accompanying paper in the same way as a Table of Contents indicates what a book will cover) or **Informative abstract** (summarizes the main findings, and probably have a background statement, and possibly something about methods)?

5. What is the main tense used in this abstract? Why is this tense used?
6. Does it have any citations or references?
7. Does the abstract author or authors use "I" or "we"?
8. Are metadiscoursal expressions (i.e. a "text about your text", as in "In the following section, we offer a computer simulation")? If so, what nouns are used?
9. What move structure does it have?

Ex. 2

The following abstract, from a fictitious paper entitled *An innovative methodology for teaching English pronunciation*, has a series of problems.

> The English language is characterized by a high level of irregularity in spelling and pronunciation. A computer analysis of 17,000 English words showed that 84% were spelt in accordance with a regular pattern, and only 3% were completely unpredictable [Hanna et al., 1966]. An example of unpredictability can be found in English numbers, for example, *one, two* and *eight.* Interestingly, English spelling a thousand years ago was much more regular and almost phonetic. Words that today have a similar spelling but radically different pronunciation, such as *enough, though, cough, bough* and *thorough,* once had different spellings and much more phonetic pronunciations. In this paper, a pioneering method, developed by the English For Academics Institute in Pisa (Italy), of teaching non-native speakers how to quickly learn English pronunciation is presented and discussed.

The problems are:

- it is not self-sufficient. If readers read this abstract in isolation from the paper, they would have no idea about what the author actually did in his / her research, nor what was found
- it looks like the beginning of an Introduction not an Abstract. Apart from the last line it is all background information. This information is interesting and relevant to the topic of the paper. But it is not new information. Basically, it tells the reader nothing about what contribution the author has made to this field of study
- it contains a reference to another authors work, Hanna. This is not common in an Abstract
- it mentions irrelevant details. In an abstract the reader does not really need to know where the research was carried out, particularly in this case where the exact location of the research (Pisa, Italy) is totally irrelevant – it has no impact on the findings
- the pioneering method is not described, nor do we have any idea about why it is 'pioneering'
- the reader has no idea of what results were obtained

The result is that readers in this field – English pronunciation – are likely to skip this article and move on to the next one they find. A better version of the abstract would be:

We have developed a didactic method for addressing the high level of irregularity in spelling and pronunciation. We combine new words, or words that non-native speakers regularly have difficulty in pronouncing, with words that they are familiar with. For example, most adult learners have few problems in pronouncing *go, two, off and stuff* but may have difficulties with *though, cough* and *rough.* Through associations – *go / though, two /through, off/cough, stuff / tough* – learners can understand that familiar and unfamiliar words may have a similar pronunciation and can thus practice pronouncing them without the aid of a teacher. Tests were conducted on 2041 adults selected at random from higher education institutes in 22 countries and incorporating five different language families. The results revealed that as many as 85% of subjects managed to unlearn their erroneous pronunciation, with only 5% making no progress at all. We believe our findings could have a profound impact on the way English pronunciation is taught around the world.

Why is the revised version better? Make a list of reasons:

- because …
- because …
- because …
- ……

Ex. 3

Find an abstract from an article in yor research field and analyse it using the questions from ex. 1.

Ex. 4

Phrases for abstracts and introductions.

4.1. Insert the words below into the spaces.

addresses, aim, aimed at, aims to, continuation, feasibility study, framework, propose, scope, targeted, this end, undertook

1. Our _____ is to provide a short, practical analysis of how this language is used.
2. This article _____ define the difference between a hazard and a danger.
3. This article is the result of a _____ investigating...
4. This work _____ the problems inherent in...
5. This work is a direct _____ of the work begun by Zappata [2014].
6. To _____ we have tried to...
7. We have _____ funding as being our main priority.
8. We _____ a new code for calculating the number of hours required.
9. We _____ this study to...
10. Within the _____ of these criteria, we propose to...
11. Defining P and Q falls outside the _____ of this article.
12. It is _____ students of engineering.

4.2. In each sentence delete the one word /phrase that is not appropriate / grammatical.

1. This paper **outlines / proposes / describes / discovers / presents** a new approach to...
2. This paper **validates / examines / seeks to address / focuses on / discusses / investigates** how to solve...

3. This paper is **an overview of / a review of / a report on / a preliminary attempt** how bilinguals separate the two languages while talking.
4. The aim of our work is to **further / extend / widen / broaden / amplify** current knowledge of...
5. This paper **takes a new look at / re-examines / revisits / informs / sheds new light on** how politicians use their power,
6. In the literature, 'psychotic' **usually refers / often refers / is usually referred to** a patient who...
7. Vitous [2015] has **provided / put forward / put down / proposed** a new definition of X, in which...
8. In the literature **there lacks of a general definition of X / a general definition of X is lacking / there is no clear definition of** X.
9. In their **seminal / groundbreaking / cutting edge / state-of-the-art paper** of 2001, Peters and Jones...
10. Experiments on X were **conducted / carried on / carried out / performed on** X in 2009 by a group of researchers from...
11. More recent evidence [Obama, 2013] **shows / suggests / investigates / highlights / reveals / proposes** that.
12. He **claims / argues / criticizes / maintains / suggests / points out / underlines** that...
13. Kamos's [23] assumptions seem to be **sensitive / realistic / well-founded / well-grounded / plausible / reasonable / acceptable**.
14. Many experts contend, **however / instead / on the one hand**, that this evidence is not conclusive.
15. This has led authors **as / such as / for example / for instance** Mithran [32], Yasmin [34] and Hai [35] to investigate...

Ex. 5

Grammar for abstracts.

5.1. Chose *Present Simple* or *Past Simple*

An increase in storm frequency and intensity (1) ***is / was*** expected for the Mediterranean area. The aim of this study (2) ***is / was*** to assess the risk of soil erosion in sub-basin croplands in Tuscany, Italy. We (3) ***explore / explored*** the potential response of soil erosion patterns to changes in temporal distribution and intensity of rainfall events, land-use, and soil conservation management practices by analyzing various scenarios. Most soil erosion (4) ***is / was*** associated with a limited number of intensive-to-extreme rainfall events. An analysis on a sub-hourly basis (5) ***is / was*** carried out using the SWAT model. Our analysis (6) ***highlights / highlighted*** three specific management strategies that may help in preventing or reducing cropland erosion. We (7) ***predict / predicted*** that these strategies could reduce erosion by up to 25% in the studied area over the next ten years.

5.2. Chose *Present Simple, Present Perfect* or *Past Simple*

With its focus on the research cycle, scientific methodology (1) ***has devoted / devoted a*** great deal of attention to problem solving. However, the issue of problem choice (2) ***has been / was*** relatively neglected, notwithstanding its relevant epistemological implications. What (3) ***are / have been*** the criteria used by PhD students to set their research agenda? To what extent (4) ***is / was*** the research agenda driven by pure curiosity about social phenomena? A survey (5) ***has been / was*** carried out among PhD students of European universities to examine the criteria used in the choice of their dissertation topics over the last decade. The analysis thus sheds light on the way scientific knowledge (6) ***is / has been*** crafted in the last ten years, and about the challenges and limitations researchers (7) ***have faced / faced*** during this process.

ASSIGNMENT 12

12.1. Analyse the **abstracts** of the articles from your research field. Are they informative or indicative?

12.2. Are they structured or unstructured?

12.3. What moves do they consist of?

12.4. What type is the opening sentence?

12.5. What clichés or 'skeleton phrases[1]' are used?

12.4. Write the abstract for your own article.

[1] *Skeleton phrases* – typical phrases or sentences which are often found in research articles and can be adapted for writing your own sentences by adding the content words. The lists of skeleton phrases for each section of a research article are given in Appendix 3.

Appendix 1

Renewable and Sustainable Energy Reviews 16 (2012) 1291–1299

Contents lists available at SciVerse ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

Carbon sequestration by forestation across China: Past, present, and future

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ARTICLE INFO

Article history:
Received 2 March 2011
Received in revised form
26 September 2011
Accepted 12 October 2011
Available online 1 December 2011

Keywords:
Carbon sequestration
Plantation forests
Trends
China

ABSTRACT

Plantation forests are the most effective and ecologically friendly way of absorbing CO_2 and increasing carbon sinks in terrestrial ecosystems; mitigating global warming and beginning ecological restoration. China's forestation rate is the highest in the world, and contributes significantly to the nation's carbon sequestration. We have applied empirical growth curves, scale transformations, field sampling plots, and forest inventory data, to our carbon estimation model, to analyze the carbon sequestration in living biomass and soil organic carbon pools in past and current plantations. Furthermore, the potential carbon sinks of future plantations, 2010–2050, have been simulated. From 1950 to the present, plantations in China sequestered 1.686 Pg C by net uptake into biomass and emissions of soil organic carbon. The carbon stock of China's present plantations was 7.894 Pg C, including 21.4% of the total sequestration as forest biomass and 78.6% as SOC. We project that China's forestation activities will continue to net sequester carbon to a level of 3.169 Pg C by 2050, and that carbon stock in plantations will amount to 10.395 Pg C. Spatial patterns of carbon sequestration were dissimilar to those of planting area. On the basis of area, carbon sequestrations were highest in North China, while changes were generally greatest in the Northeast and Southwest regions.

Contents

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1. Introduction

Global climatic warming and rapidly increasing CO_2 concentrations, primarily resulting from anthropogenic activities and land use changes, have led to growing concerns about measures for energy saving, emission mitigation, and carbon sink enhancement. Gaining new carbon through forestation has become the most effective, hopeful, and ecologically friendly measure to enhance carbon sequestration in terrestrial ecosystems and mitigate increasing CO_2 concentrations in the atmosphere. Large scale forestation will establish large areas of new vegetation to enhance carbon sinks, conserve soils, and improve water quality [1–3]. Forestation is also the primary driving force for transformation between carbon sinks and sources [4–9]. Tree plantations allow the carbon to be sequestered in biomass, thus playing a vital role in the terrestrial carbon sink [3,10–14]. Sequestering carbon in the soil, ultimately as stable humus, may well prove a more lasting solution than temporarily sequestering it in biomass [2,3,15]; soil sequestration would be the most effective in mitigating climatic warming in the long term. However, like any large-scale land use change, plantations can have unintended environmental and socioeconomic impacts that can jeopardize the overall value of carbon mitigation projects [1,16].

Previous investigations have touched upon carbon sequestration as well as changes in forest ecosystems on national, regional, or plot scales [17]. Woodbury et al. [18] estimated that forestation caused sequestration averaging 17 Tg C $year^{-1}$ in the USA between 1990 and 2004, including 6 Tg C $year^{-1}$ in the soil and 11 Tg C $year^{-1}$ in the forest floor. Fang et al. [8] estimated that planted forests sequestered 0.45 Pg C between the mid-1970s and 1998, and that the average carbon density increased from 15.3 to 31.1 Mg C ha^{-1}. Liu et al. [19] pointed out that 21.3 Tg carbon was sequestered in new plantations in China under the Natural Forest Conservation Program between 1998 and 2004. Reviews have shown that carbon biomass is influenced by forest type, climate, soil, topography, and human activity [20]. However, the changes in soil organic carbon (SOC) that follow forestation are still under debate, and are influenced by vegetation production, soil conditions, land use history, the type of forest established, and forest management [21]. SOC after planting may increase [22,23] or decrease [12,14,21,24]. However, most reviews have presented initial losses in SOC, followed by slight increases [20,23,25,26]. Potential carbon sinks of forestation at regional or global scales have also been estimated. Global afforestation and reforestation have the potential to sequester 60–90 Pg C between 1995 and 2050, according to Land Use, Land-Use Change and Forestry (LULUCF) reports [27]. Niu and Duiker [28] predicted that carbon sequestration on the marginal croplands of the midwestern USA would be 508–540 Tg C over 20 years, and 1018–1080 Tg C over 50 years, following forestation; this could offset 6–8% of current CO_2 emissions. Xu [29] calculated that about 9.7 billion tons of carbon would be sequestered under perpetual rotation, if the total land available (1.3 billion ha) in China were afforested. Chen et al. [30] showed that the potential carbon sequestration by grain, under the Green Program in Yunnan Province, will increase carbon in that province by 49.92–56.62 Tg by 2050; this amounts to 10.82–12.27% of the provincial forest carbon stocks of the 1990s.

However, little research has focused on carbon sequestration of the large scale tree planting programs in China. The absorption of CO_2 by plantations is even less well known and remains unclear. Preserved plantation area in China is 0.617×10^8 according to the Seventh National Forest Resources Inventory 2004–2008; accounting for one third of the plantation area in the world. Plantations have contributed significantly to carbon sequestration in China, and will continue to do so. With gradually expanding area and increasing forest age, it is timely to investigate annual variation in the carbon sink functions of plantations. Our purpose is to analyze the carbon sequestration in the living biomass and the soil organic matter induced by forestation in China, in the past and present, and also to simulate the carbon sink potential of future plantations.

2. Materials and methods

Carbon sequestration and the potential of plantations are expressed as carbon stock changes in tree biomass and soil organic matter. Although carbon stock in dead organic matter (litter and dead wood) increases after forestation on cropland or barren land, we have not estimated its changes due to unavailable data and lower change rates relative to living tree biomass. We have developed empirical growth curves for different tree species in each region, based on data from the sampling plots of the National Forestry Inventory. These data were used to estimate carbon sequestration in the tree biomass pools including basic wood density, biomass expansion factors, and carbon fractions. SOC change factors were introduced to estimate the stock change in SOC pools. Terrestrial China was divided into seven regions (Fig. 1 and Table 1) following the scheme of the Chinese Natural Regionalization. These are Eastern China (EC), Northeastern China (NE), Northern China (NC), Southern China (SC), Southwestern China (SW), Northwestern China (NW), and the Tibetan Plateau (TP).

2.1. Forestation data

2.1.1. Past forestation

The planted area of each region in China between 1950 and 2010 was collated from the Yearly Forestry Reports (1949–2009) edited by the Forestry Department of China. Choice of tree species for forestation was therefore based on the dominant plantation species

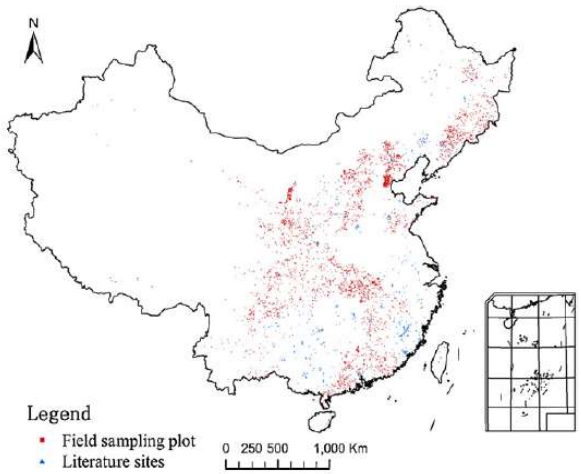

Fig. 1. Sites of field sampling plots and data gained from the literature.

Table 1
Proportions of species planted in each region.

Region	Primary planting species	Proportion/%	Region	Primary planting species	Proportion/%
EC	*Cunninghamia lanceolata*	44.5	SC	*Cunninghamia lanceolata*	32.2
	P. massoniana	15.7		*Eucalyptus*	29.3
	Keteleeria	16.1		*Keteleeria*	12.5
	Populus	11.2		*Casuarina equisetifolia L.*	10.1
	P. elliottii	8.8		*P. elliottii*	6.6
	Eucalyptus	3.7		*P. massoniana*	5.3
NE	*Larix*	48.3		*Picea*	2.1
	Populus	20.4		*Cupressus funebris*	1.9
	P. tabulaeformis	11.0	NC	*P. tabulaeformis*	25.5
	P. koraiensis	8.8		*Populus*	34.7
	P. sylvestris	6.1		*Larix*	15.2
	Picea	4.1		*Cunninghamia lanceolata*	8.7
NW	*Populus*	85.5		*Robinia pseudoacacia L.*	7.2
	P. tabulaeformis	9.5		*Cupressus funebris*	4.6
	Picea	2.7		*Keteleeria*	2.4
	Larix	2.3		*P. armandii*	1.7
SW	*Cunninghamia lanceolata*	42.2	TP	*Populus*	35.0
	P. massoniana	24.1		*Salix babylonica*	25.0
	P. armandii	14.4		*Picea*	15.0
	P. yunnanensis	7.4		*Hippophae rhamnoides Linn.*	10.0
	Cupressus funebris	6.5		*Betula*	7.5
	Eucalyptus	3.1		*Larix*	7.5
	Cryptomeria	2.3			

at the time, and planted species were recorded in the National Forest Inventory (Table 1).

2.1.2. Future forestation

Future demand for increasing forest area or coverage and likely tree species have been estimated based on mid-term (to 2020) and long-term (to 2050) national and provincial forest planning strategies. Based on the national target for forest planning up to the year 2050, for example, we have predicted that 301,746 ha of land will be planted between 2010 and 2050, including 113,758 ha of eligible cropland and 187,986 ha of barren land. Furthermore, forest coverage is planned to reach 20.3%, 23.4% and 28% in 2010, 2020, and 2050, respectively. Additionally, the Chinese government has promised that the forest area will increase by 0.4×10^8 hm^2 and the forest stock volume will increase by 13×10^8 m^3 in 2020, from 2005 levels. This was described in the proposed climate mitigation actions that China submitted to the UNFCCC at the 2009 Copenhagen Conference (Table 2).

2.1.3. Data from field sampling plots

Data from sampling plots in plantations at 9078 sites was provided in the National Forestry Inventory, conducted once every 5 years since the 1970s. Recorded parameters include stand volume, tree species, site conditions, age classes, soil depths, and soil types (Fig. 1).

2.1.4. Data from the literature

We collated the measured plantation biomass from 1209 field plots including the spatial distribution and representativeness of each plantation type, from Luo [31], Zhou et al. [32], Shi [33], and Zhao and Zhou [34]. This data covered 36 major tree species representing a wide range of China's plantation types and field site conditions (Fig. 1).

2.2. Several assumptions in estimating carbon sequestration

2.2.1. The average growth curves of plantations in each region

The average growth curves of plantations in each region played a crucial role in our estimation of carbon sequestration in biomass. Growth curves were fitted to the stand volume of established plantations varied with site conditions for each region, and were used to represent mean growth under diverse climates, site conditions, and forest disturbances. Therefore, use of the mean growth curves may have led to overestimation (worse site conditions) or underestimation (better site conditions).

2.2.2. Reforestation considering harvest

Prior to 2000, more than 60–90% of planted forests were commercial plantations, with a regulatory rotation age of less than 30 years following the regulations in the Forest Management Inventory. Since 2000, commercial plantation area has decreased to 46.52% (1999–2003) and then to 35.38% (2004–2008) according to the Forestry Yearbook. Therefore, over 55.07% and 57.06% of

Table 2
Governmental planning of future planting, 2000–2050 (km^2).

Region	2000–2010	2010–2015	2015–2020	2020–2050	Primary planting tree species
EC	69734.42	5881.99	5881.99	12708.27	*Cunninghamia lanceolata, P. massoniana, P. elliottii, Populus, Lauraceae, Cryptomeria*
NC	5496.60	5496.60	32022.30	5496.60	*Populus, Cupressus funebris, P. tabulaeformis, Salix babylonica, Robinia pseudoacacia L., P. bungeana*
NE	55441.61	15067.02	15067.02	22545.57	*Populus, Larix, Picea, P. tabulaeformis, Abies, P. koraiensis, P. bolleana, P. sylvestris, Cupressus funebris, Robinia pseudoacacia L.*
NW	33784.62	8763.22	8763.22	16372.6	*P. bolleana, Ulmus pumila L., Hippophae rhamnoides Linn., Picea, P. tabulaeformis, Cupressus funebris, P. armandii, Larix, Robinia pseudoacacia L., P. sylvestris*
SC	38173.44	4663.34	4663.34	6252.32	*Eucalyptus, P. massoniana, Cunninghamia lanceolata, P. elliottii, Casuarina equisetifolia L.*
SW	69912.58	7411.93	7411.93	20181.43	*Cunninghamia lanceolata, P. massoniana, P. armandii, Eucalyptus, Cupressus funebris, P. elliottii, P. yunnanensis*
TP	6569.58	4207.48	4207.03	3452.96	*Populus, Larix, P. tabulaeformis, Picea, Abies, Cupressus funebris*

Table 3
Parameters used to calculate the carbon biomass sequestration of plantations.

Tree species	Growth model	a	b	c	r^2	BEF	WD	CF	MR
P. yunnanensis	Logistic	54.49	3.51	0.20	0.88	2.04	0.483	0.54	51
P. massoniana	Korf	116.42	3.424	0.430	0.64	2.13	0.542	0.52	41
P. tabulaeformis	Richards	98.85	0.027	1.782	0.822	2.06	0.492	0.51	41
Larix	Gompertz	75.014	0.165	12.055	0.89	1.74	0.490	0.51	61
P. armandii	Logistic	69.38	2.53	0.09	0.75	2.29	0.396	0.50	51
P. sylvestris	Logistic	151.89	3.33	0.08	0.60	2.36	0.375	0.41	41
P. elliottii	Richards	69.18	0.09	1.22	0.60	2.13	0.542	0.52	41
P. koraiensis	Korf	113.52	9.44	0.62	0.67	2.24	0.468	0.49	61
Cunninghamia lanceolata	Gompertz	149.825	1.182	0.061	0.93	1.92	0.307	0.49	36
Betula	Korf	119.58	222.14	1.61	0.69	1.62	0.541	0.50	51
Eucalyptus	Richards	85.48	0.14	2.80	0.55	1.65	0.578	0.50	26
Cupressus funebris	Richards	36.41	0.05	1.94	0.51	2.11	0.478	0.50	101
Abies	Richards	365.18	0.02	5.04	0.71	2.12	0.366	0.49	61
Picea	Logistic	184.86	4.34	0.11	0.68	2.12	0.342	0.51	101
Cryptomeria	Logistic	48.63	3.45	0.39	0.71	1.91	0.294	0.50	36
Keteleeria	Logistic	53.25	2.39	0.10	0.57	2.23	0.448	0.50	51
Lauraceae	Korf	100.04	17.81	0.68	0.76	1.89	0.46	0.49	71
Populus	Korf	319.61	5.06	0.33	0.59	2.16	0.378	0.51	60
P. bolleana	Korf	99.12	7.53	0.75	0.94	2.16	0.378	0.51	30
Salix babylonica	Richards	49.05	0.25	5.41	0.71	2.31	0.465	0.50	16

the later established forests are so-called Ecological Service Forests (noncommercial plantations), that are not allowed to be harvested until over-mature according to the Technical Regulations for Ecological Service Forest. We assumed that plantations would be regenerated after clear cutting when they exceeded a minimum rotation age. It was assumed that all harvested biomass would decompose immediately and all harvested lands would be regenerated immediately after harvest, and that the aboveground parts of all cut trees would be cleared away. We also assumed that the initial volume of soil organic carbon after reforestation was equal to the volume before regeneration. In addition, the carbon sequestration of harvested wood products was not considered. Average minimum rotations were determined in accordance with the primary tree species planted, and the regulations in the Forest Management Inventory (Table 3).

2.2.3. Survival rate and area not harvested

We can see that total area of forest planted (2004–2008) has been well exceeded by the current plantation area (61.65% of the established plantation area), and about 40% of the established plantation area has been harvested (Table 4). The contribution ratios of plantation to forest coverage in China (5 or 10 years after planting) were less than 50% [35]. This illuminated the relatively lower survival rate of plantations and the harvesting of commercial stands. According to statistics data from the State Forestry Administration of China, the survival rates of plantings in NC, NE, EC, SC, NW, and TP prior to the 1990s were 40%, 50%, 60%, 75% and 70%, and since then should be over 85%, 70%, 85%, 75%, and 90%, respectively.

2.2.4. Soil organic carbon before planting

We adopted soil organic carbon density data from Wang et al. [36] as a baseline for calibration of SOC. The soil organic carbon density data included the physiochemical properties of every soil stratum from 2473 typical soil profiles; these profiles were collected for the Second National Soil Survey of soil subtypes.

2.3. Biomass carbon change of forestation

The carbon sequestration change method was adopted following Chen et al. [30] and utilized for the estimation of carbon biomass stocks in living trees. The formula was as follows:

$$CS_i = \sum_i \sum_j \sum_k A_{ijk} V_{ijk} WD_{ij} BEF_{ij} CF_{ij} \quad (1)$$

where CS_i corresponds to carbon sequestration (Mg C) in living tree biomass in region i, A_{ijk} represents the corrected area (ha) of species j planted or to be planted in year k in region i, V_{ijk} indicates stand volume per hectare ($m^3\ ha^{-1}$), WD_{ij} is the basic wood density ($Mg\ m^{-3}$), BEF_{ij} is a biomass expansion factor (dimensionless) for conversion of stem biomass to stand biomass (including stems, branches, foliage, and roots), and CF_{ij} is the carbon fraction ($Mg\ C\ Mg^{-1}$) (Table 3). The biomass expansion factor and basic wood density used in the estimate were from the China Initial National Communication. Carbon fractions were derived from the literature. The minimum rotation (MR) periods for major species within Ecological Service Forest are listed in Table 3.

These data represent average growth values of stand volumes under different site conditions and forest management practices. The stand volumes of different tree species in plantations in different regions were fitted against age classes using Matlab software and applying four theoretical growth models (Richards, Korf, Logistic and Gompertz, Eqs. (2)–(5)). The best model was then chosen and used (Table 3).

$$V_{ijk} = a \cdot [1 - \exp(-b \cdot age)]^c \quad (2)$$

$$V_{ijk} = a \cdot \exp\left(\frac{-b}{x^c}\right) \quad (3)$$

$$V_{ijk} = \frac{a}{1 + \exp(b - cx)} \quad (4)$$

$$V = ae^{(-e^{b-cx})} \quad (5)$$

2.4. Soil organic carbon change induced by forestation

The organic carbon pool in the soil may be a potential long-term sink following forestation. However, changes in soil organic carbon following forestation vary significantly with the land use/cover types before planting and other bio-physical conditions, and changes are usually non-linear over time [20,37]. SOC stock changes were estimated using the formula:

$$SoilCS_i = \sum_i \sum_j \sum_k A_{ijk} R_i SoilCS \quad (6)$$

where $SoilCS_i$ corresponds to the carbon stock change (Mg C) in the SOC pool in region i, A_{ijk} represents the area (ha) of species j planted or to be planted in year k in region i, R_i represents the factor of SOC stock change ($Mg\ C\ ha\ year^{-1}$), and $SoilCS_i$ is the original value of SOC before planting. The decomposition and accumulation rates of

Table 4
Plantation variables, 1950–2008.

Periods	Planting area/10^6 hm^2	Plantation area/10^6 hm^2	Plantation coverage/%	Forest coverage/%	Plantation without harvest/%	Contribution ratio of plantation/%
1950–1962	34.11		0.53	12.70		17.69
1973–1976	56.13	28.20	2.47	12.00	7.5	35.35
1977–1981	22.44	27.81	2.31	12.98	10.47	18.34
1984–1988	43.63	31.01	3.23	13.92	14.24	49.82
1989–1993	27.76	33.79	3.57	15.12	14.79	44.49
1994–1998	25.29	36.42	4.86	16.55	16.55	50.24
1999–2003	31.85	46.67	5.55	18.21	38.34	52.52
2004–2008	20.16	61.65	10.44	20.36		43.47

Table 5
Parameters used to calculate changes in SOC rates in different regions.

Region	North	Northeast	South	Central	Southwest	Northwest	TP
a	1.07	0.94	1.50	1.26	1.35	0.89	0.78
b	2.78	2.50	3.10	2.94	3.00	2.20	2.00

soil organic carbon after forestation varied due to differing regional hydrothermal conditions, rates of tree growth, and rates of canopy closure. The rate of SOC stock change can be fitted following the methods of Post and Kwon [37], Paul et al. [20], and Huang et al. [26] as follows; parameters a and b for each region are listed in Table 5.

$$R_i = a \cdot \ln \quad age - b \tag{7}$$

3. Results

3.1. Spatiotemporal variations in forestation in China

Forest coverage and forest area in China have decreased since 1950 and then tended to increase after the 1970s as a result of massive forestation campaigns, referred to as the largest land-use change projects in China. Plantings between 1950 and 2009 totaled about 130.09×10^6 hm^2 in area, and annual planting areas averaged 2.17×10^6 hm^2, ranging from a minimum of 0.34×10^5 hm^2 in 1950 to 9.12×10^6 hm^2 in 2003. Plantation coverage increased from 0.53% in 1950 to 10.44% in 2008 (Fig. 2). However, the plantation area in existence was only 61.65×10^6 hm^2 at present (Table 4), indicating a very low survival rate and the cutting of plantations for timber. We have predicted that 21.65×10^6 hm^2 of land will be planted in China between 2010 and 2050. Our estimate of annual area planted during this period is outlined in Table 2.

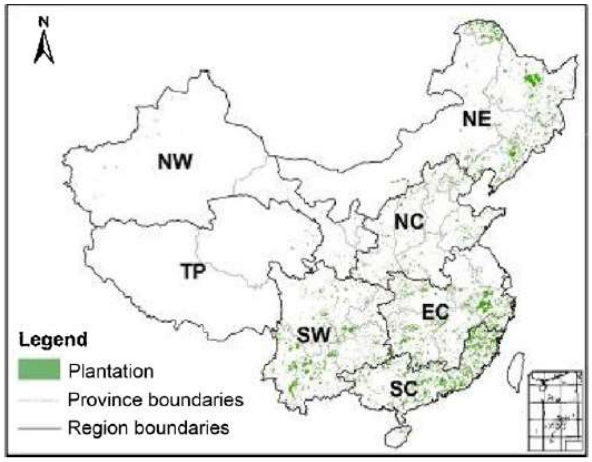

Fig. 2. Distribution map of plantations.

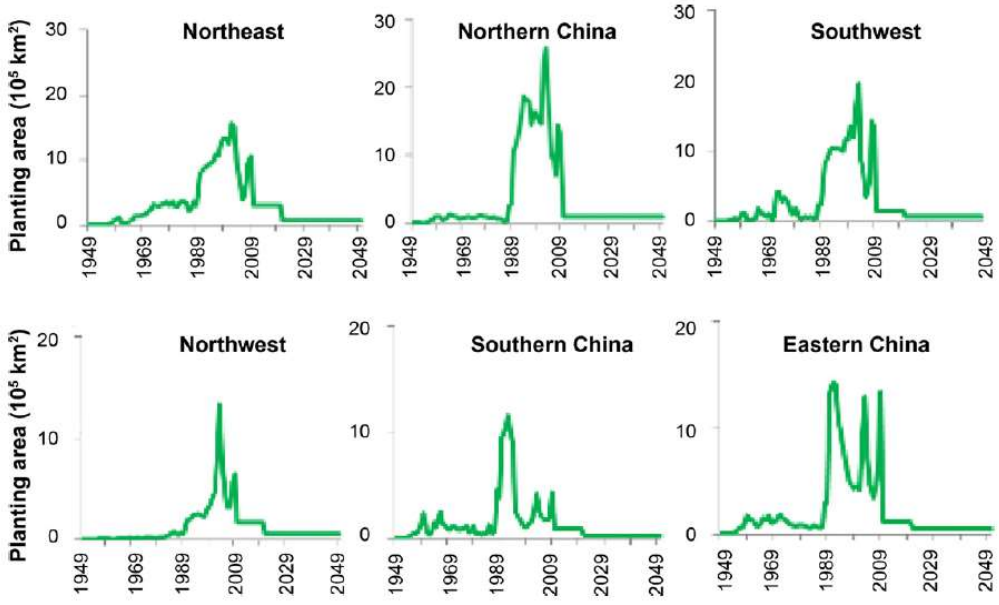

Fig. 3. Annual forestation areas between 1950 and 2009.

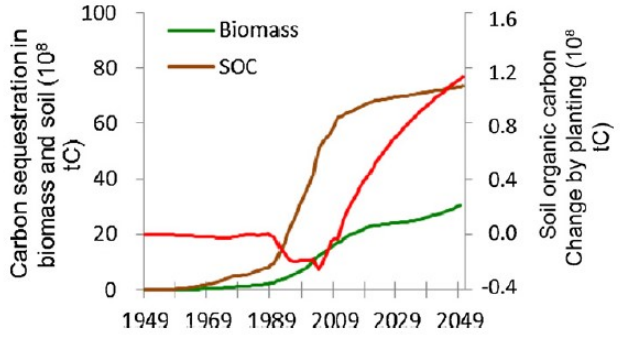

Fig. 4. Annual carbon sequestration of forestation between 1950 and 2050.

Between the 1950s and 1960s, forestation focused on the planting of timber plantations. More than 7.09×10^6 hm^2 of plantations were established, with an annual average area of 0.36×10^6 hm^2. In the 1970s, the Three-North Shelter Forest Program and the Plain Greening Project were launched, and aerial seeding was used. The annual average area of newly planted forests increased to 0.84×10^6 hm^2, more than four times the previous rate. In the 1980s, economic plantations and orchards (including palm oil, rubber, and coconut) reached nearly one billion hectares in area; the annual average planting area was 0.822×10^6 hm^2. From the late 1990s to 2009, six key forest projects were begun, including the Natural Forest Protection Project and the Green for Grain Project. The increased average planting area was 5.32×10^6 hm^2 per year, with a total of 106.31×10^6 hm^2.

The largest area of planting has been in Northern China. This accounts for 25.19% of the total in China. Primary tree species were *P. tabulaeformis*, *Populus*, *Larix* (Table 1). Much of the remaining (21.57%) planting occurred in the Northeast region (Fig. 3), with primary tree species *Larix*, *Populus*, *P. tabulaeformis* (Table 1). Southwestern China accounted for 19.35%, and Eastern China for 14.67%. Interestingly, the two regions with opposite climates (tropical and subtropical Southern China, and the arid and semiarid Northwestern) showed similar trends in planting area to the other regions, accounting for 8.98% and 8.57% of the planted area, respectively. The Tibetan Plateau, where planting has been limited by the high-cold conditions, accounted for only 1.67%.

3.2. Carbon sequestration of forestation in China, 1950–2050

Carbon biomass sequestration, soil carbon changes, and the net budget of China's plantations for the 1950–2050 period are illustrated in Fig. 4. Carbon biomass sequestration has shown continued increase, especially since 2000. However, changes in SOC induced by China's forestation activities showed a decrease until recently, and then an increase. Between 1950 and 2010, total carbon sequestration from forestation amounted to 1.686 Pg C, including 1.689 Pg C sequestered in biomass, and 0.003 Pg C released into the atmosphere by the soil. The SOC storage of plantations totaled about 6.205 Pg C in 2010. The net carbon sequestration in the 1950s was 0.004 Pg C, including 0.005 Pg C in tree growth and 0.001 Pg C in soil carbon emissions. Comparison of net carbon sequestration for the decadal showed that forest carbon sequestration in the 1960s, 1970s, and 1980s were 8.5, 28, and 56 times larger than the baseline in the 1950s. In the 1990s, total carbon sequestration from forestation activities amounted to 0.702 Pg C, including 0.721 Pg C in tree growth and 0.019 Pg C in soil carbon emissions. With an current area of 61.65 M ha, China's plantations presently have a carbon stock of 7.894 Pg C, including 1.689 Pg C in biomass and 6.205 Pg C in SOC, with the net negative change in SOC due to forestation totaling 0.003 Pg C. The average carbon biomass density was 27.397 Mg C ha^{-1}, and the average SOC density was 100.65 Mg C ha^{-1}.

Between 2010 and 2050, the net carbon sequestration potential from newly planted forests is projected to be 2.51 Pg C, or 24.13% of the total. Under current governmental planning scenarios, the net carbon sequestration of the plantations in China is expected to be 2.077 Pg C by 2015, and 2.327 Pg C by 2020. This would include carbon sequestrations in living tree biomass of 2.052 Pg C and 2.283 Pg C, and in SOC stock changes 0.025 Pg C and 0.044 Pg C, correspondingly. Up until 2050, the net cumulative carbon sequestration from forestation activities in China is predicted to be 3.169 Pg C and the carbon stock in plantations is predicted to amount to 10.395 Pg C, including 3.055 Pg C in biomass and 7.34 Pg C in SOC, with a net change in SOC of 0.114 Pg C (Fig. 4).

3.3. Uneven regional distribution of carbon sequestration

The carbon sequestration of plantations in the seven regions of China has shown generally similar patterns in net carbon biomass sequestration over time (Fig. 5a), with a net loss of soil organic carbon prior to the 1990s–2000 period, and a gain in SOC following this (Fig. 5b). Following planting, forest biomass dynamics change more quickly than those in the soil. Furthermore, the rate of sequestration is predicted to increase in the future. The patterns of biomass sequestration in the Northeast, Northern, and Southwest regions were different from those in the other regions, with the largest, rapidly increasing rate of biomass carbon sequestration between 1950 and 2050 in the former regions. The effect of forestation in the Northeast was greater than in any other region. The Eastern, Southern, and Northwest of China showed an increasing rate of carbon biomass sequestration; equal to half the largest rate between 1950 and the present. For these regions we have predicted the slowest decreasing rate of continued sequestration through to 2050. Similar trends in SOC in each region, including a steady loss of carbon in the past and then an increase, and differences in change rate and time taken to reach to minimum values, varied from the 1990s to the

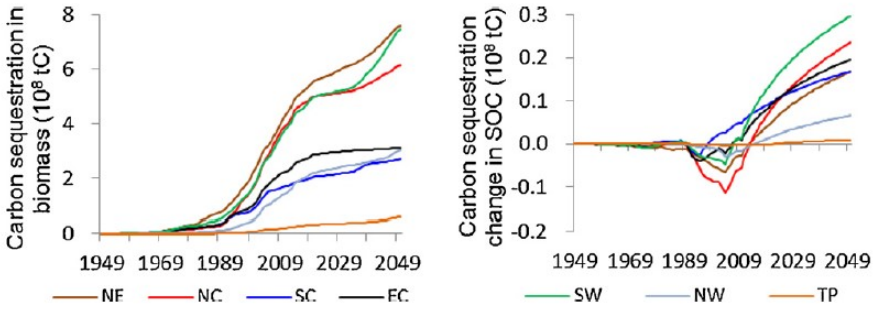

Fig. 5. Annual carbon sequestration in biomass (a), and carbon sequestration change in SOC (b), induced by forestation in each region between 1950 and 2050.

present. Unlike in most other regions, there was minimal biomass sequestration and almost no net loss or gain in the Tibetan Plateau during any period. This pattern was due to the slower growth and very low survival rates of plantations in this region.

4. Discussion

4.1. Uncertainties in estimation of carbon sequestration

Our effort to estimate plantation carbon sequestration across a wide range of spatial and temporal scales, includes uncertainties from provincial variables, modeling logic, and estimation parameters. Quantifying model uncertainties allows carbon estimates to be reported with known levels of confidence [38,39]. Identifying and minimizing these inaccuracies will improve model predictions. Uncertainty issues in carbon sequestration assessment are starting to be recognized from reserving rather than cutting areas of plantation. Such differences can be considerable and could have significant impacts on carbon sequestration. Uncertainties also arise from the estimated parameters derived from the literature, and from bio-physiological observations, such as survival rates, soil carbon densities, and rates of change of SOC in different regions and age classes. Variation in the rate of change in soil carbon stocks related to surrounding conditions, field sampling, and technical measurements, may cause deviations in modeling. In addition, to gain more accurate estimation, we need to take into account the carbon sequestration of the understory and of harvested wood products; lack of this data may lead to underestimation. However, the carbon in wood products was not considered because it was difficult to know the quantity of wood harvested.

The largest uncertainty in our projections relates to uncertainties about future area and species. Many factors will prevent future forestation including social, organizational, economic, and market-imposed constraints such as population growth, the need for agricultural land, and government policies [10]. Subsequently, large-scale plantations may interfere with other priorities for land use that determine the availability of land, the rate at which plantations can be established, and the long-term sustainability of projects. Land that is suitable for forestation may not actually be available. Once these factors are taken into account, the area of land that will actually be available for plantations is reduced. Furthermore, our current estimation does not consider the impact of climate change on growth and decomposition rates. Previous research and reviews have predicted that the net primary production of our forests would increase under the scenario of increasing atmospheric CO_2. Nonetheless, the effects of environmental change on forests in the past have already been accounted for in the inventory data, and so were partially represented in the estimation model. However, our future estimates do not take into account the impacts of climate change.

In addition, any simplified estimation generally ignores the impacts of disturbances and the stochastic process of recovery [18,40,41]. Therefore, the effects and mechanisms of stress or disturbances on forest carbon cycling need to be urgently addressed in estimation and assessment of the carbon sink of forest ecosystems. We have raised some questions and concerns. How does varying plantation management impact the forest carbon cycle? Also, the forest carbon feedback loops following natural disasters such as fires, snowstorms, insects, earthquake, or tsunami are rarely able to be observed.

4.2. Trade-offs between carbon sequestration and other ecosystem services

Carbon sequestration strategies have highlighted tree plantations without considering their full environmental consequences. Although sequestering carbon in forests is good for the climate, other outcomes such as loss of biodiversity and local incomes, decreased food security, decline in soil fertility, reduced stream flows, and increased fires and insects may result. Forests also affect the biophysical properties of the land surface, such as the sunlight reflectivity (albedo) and evaporation rate; with further implications for the radiative forcing of climate. The co-benefits and trade-offs of plantations need to be taken into account when negotiating exchange agreements. Joint use of carbon sequestration and the provision of forest-derived products (e.g. timber and biomass for energy) will optimize the contribution of forestry in climatic mitigation. This is particularly attractive in temperate regions where land availability is limited by high land prices and strong competition with other land uses. Well-directed carbon sequestration projects, therefore, that also provide sustainably produced timber, fiber, and energy, will yield numerous benefits, including additional income for rural development, prospects for conservation and other environmental services, and support for indigenous communities. Principles of sustainability must govern the resolution of trade-offs that may arise from ancillary effects in order to simultaneously maximize climate change protection and sustainable development [16].

Furthermore, we need to consider suitably adapted tree species for particular land types, especially degraded land. Hence, a careful choice of tree species used for the forestation occurring under the Kyoto protocol is needed to promote long-term climate change mitigation [2]. Reliable and reasonable forest management patterns and restoration projects, such as selective harvesting, returning residues to land, reducing human disturbance on soils, choosing nitrogen-fixing tree species, fertilizer application, planting of mixed forests, and fire prevention are also important. In addition, land use changes have been driven by social and economic conditions, and to use land purely for the purpose of carbon sequestration is impracticable. Therefore, comprehensive land use planning is necessary, including consideration of biological, economic, and social effects.

4.3. Enhancing plantation management

If China is to be the country with the maximum preserved area of plantation and largest annual planting area, urgent needs are to increase the quantity and enhance the quality of plantations by suitable forest management. Suitable measures for forest management must follow regional conditions [42]. Major strategies available to mitigate carbon emissions through forest management include increasing forest area through reforestation; increasing carbon density of existing forests at stand and landscape scales; expanding the use of forest products that sustainably replace fossil-fuels; reducing emissions from deforestation and low-impact harvesting [16]; increasing productivity by nutrient management, thinning, optimization of rotation time and species; increasing carbon sequestration by residue management, and better utilization of products from thinning.

Quantifying the sources and sinks of carbon resulting from forest management is essential for accurate estimation of national carbon fluxes, and is also helpful in meeting the greenhouse gases emission reduction targets [43]. Although the climate protection role of forests is in no doubt, there are many complexities involved in determining how much of the forest carbon sinks can be managed to mitigate atmospheric CO_2 buildup, and in what ways [16]. Furthermore, external factors such as high temperatures result in reduction of the carbon sink, and lead to much higher CO_2 concentrations than expected. Forest management therefore becomes a controversial issue if we want to solve the increased terrestrial carbon sources and decreased carbon sink [44–46]. Forest carbon management raises some interesting questions. Is carbon

management compatible with utilization of forest resources? How does carbon management enhance or detract from other ecosystem services such as water conservation and biodiversity [42]?

5. Conclusion

During the entire 1950–2050 period, the effects of forestation on biomass carbon pools were greater than the effects on soil carbon pools. Carbon biomass sequestration showed continual increase, however, SOC first decreased and then increased. Forestation caused net carbon sequestration of 1.686 Pg C from biomass and soil organic carbon until the present, and many projects continue this net sequestration into the 21st century. In summary, there remain many uncertainties in our estimates of net carbon sequestration in China's plantations. Despite these uncertainties, it is clear that forests, especially plantations, account for most of China's terrestrial carbon sink. Although not all sources of uncertainty have been fully quantified, our results suggest that statistics-based estimates may have substantially smaller uncertainties than those based on forest carbon modeling. The improved inventory-based estimates of forest carbon stocks presented here, and future refinements of these and other statistics-based estimates, should help to constrain projections from ecological modeling.

Most estimates of forest carbon stocks have neglected or seldom considered the effects of stand age. However, stand volume varies with tree species, site conditions, age classes, and forest disturbances. Young and middle-aged forest accounts for 67.85% of forests in China. The carbon budget of young or mature forest would be under or overestimated if the same parameters are applied without consideration of the impacts of forest age on stand biomass, production, and carbon sequestration. Therefore, we used methods that analyzed the carbon dynamics of different age-classes, to model the carbon sequestration of plantations, and the applicability or not of each parameter were considered. Besides deepening our understanding of increasing carbon sinks by forestation, the limitations and negatives of forestation projects should be realized, and new technologies for forestation and enhancement of carbon stocks should be exploited.

Acknowledgments

This research was supported by the Ministry of Science and Technology 973 Program (2009CB421105, 2010CB950900) and the National Natural Science Foundation (40971281, 41001366). The authors wish to thank anonymous reviewers for their constructive comments on the manuscript.

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A B S T R A C T

Plantation forests are the most effective and ecologically friendly way of absorbing $C0_2$ and increasing carbon sinks in terrestrial ecosystems; mitigating global warming and beginning ecological restoration. China's forestation rate is the highest in the world, and contributes significantly to the nation's carbon sequestration. We have applied empirical growth curves, scale transformations, field sampling plots, and forest inventory data, to our carbon estimation model, to analyze the carbon sequestration in living biomass and soil organic carbon pools in past, and current, plantations. Furthermore, the potential carbon sinks of future plantations. 2010-2050, have been simulated. From 1950 to the present, plantations in China sequestered 1.686PgC by net uptake into biomass and emissions of soil organic carbon. The carbon stock of China's present plantations was 7.894 PgC, including 21.4% of the total sequestration as forest biomass and 78.6% as SOC. We project that China's forestation activities will continue to net. sequester carbon to a level of 3.169 PgC by 2050, and that carbon stock in plantations will amount to 10.395 PgC, Spatial patterns of carbon sequestration were dissimilar to those of planting area. On the basis of area, carbon sequestrations were highest in North China, while changes were generally greatest in the Northeast and Southwest, regions.

Appendix 2

Academic Word List

List of academic words made by Avril Coxhead.
The most frequent words are marked as 1, the second as 2 and so on.

abandon	8	assume	1	comment	3	controversy	9	distort	9
abstract	6	assure	9	commission	2	convene	3	distribute	1
academy	5	attach	6	commit	4	converse	9	diverse	6
access	4	attain	9	commodity	8	convert	7	document	3
accommodate	9	attitude	4	communicate	4	convince	10	domain	6
accompany	8	attribute	4	community	2	cooperate	6	domestic	4
accumulate	8	author	6	compatible	9	coordinate	3	dominate	3
accurate	6	authority	1	compensate	3	core	3	draft	5
achieve	2	automate	8	compile	10	corporate	3	drama	8
achieve	2	available	1	complement	8	correspond	3	duration	9
acknowledge	6	aware	5	complex	2	couple	7	dynamic	7
acquire	2	attitude	4	component	3	create	1	economy	1
adapt	7	attribute	4	compound	5	credit	2	edit	6
adequate	4	author	6	comprehensive	7	criteria	3	element	2
adjacent	10	authority	1	comprise	7	crucial	8	eliminate	7
adjust	5	automate	8	compute	2	culture	2	emerge	4
administrate	2	available	1	conceive	10	currency	8	emphasis	3
adult	7	aware	5	concentrate	4	cycle	4	empirical	7
advocate	7	behalf	9	concept	1	data	1	enable	5
affect	2	benefit	1	conclude	2	debate	4	encounter	10
aggregate	6	bias	8	concurrent	9	decade	7	energy	5
aid	7	bond	6	conduct	2	decline	5	enforce	5
albeit	10	brief	6	confer	4	deduce	3	enhance	6
allocate	6	bulk	9	confine	9	define	1	enormous	10
alter	5	capable	6	confirm	7	definite	7	ensure	3
alternative	3	capacity	5	conflict	5	demonstrate	3	entity	5
ambiguous	8	category	2	conform	8	denote	8	environment	1
amend	5	cease	9	consent	3	deny	7	equate	2
analogy	9	challenge	5	consequent	2	depress	10	equip	7
analyse	1	channel	7	considerable	3	derive	1	equivalent	5
annual	4	chapter	2	consist	1	design	2	erode	9
anticipate	9	chart	8	constant	3	despite	4	error	4
apparent	4	chemical	7	constitute	1	detect	8	establish	1
append	8	circumstance	3	constrain	3	deviate	8	estate	6
appreciate	8	cite	6	construct	2	device	9	estimate	1
approach	1	civil	4	consult	5	devote	9	ethic	9
appropriate	2	clarify	8	consume	2	differentiate	7	ethnic	4
approximate	4	classic	7	contact	5	dimension	4	evaluate	2
arbitrary	8	clause	5	contemporary	8	diminish	9	eventual	8
area	1	code	4	context	1	discrete	5	evident	1
aspect	2	coherent	9	contract	1	discriminate	6	evolve	5
assemble	10	coincide	9	contradict	8	displace	8	exceed	6
assess	1	collapse	10	contrary	7	display	6	exclude	3
assign	6	colleague	10	contrast	4	dispose	7	exhibit	8
assist	2	commence	9	contribute	3	distinct	2	expand	5

expert	6	implicit	8	involve	1	normal	2	principal	4
explicit	6	imply	3	isolate	7	notion	5	principle	1
exploit	8	impose	4	issue	1	notwithstanding	10	prior	4
export	1	incentive	6	item	2	nuclear	8	priority	7
expose	5	incidence	6	job	4	objective	5	proceed	1
external	5	incline	10	journal	2	obtain	2	process	1
extract	7	income	1	justify	3	obvious	4	professional	4
facilitate	5	incorporate	6	label	4	occupy	4	prohibit	7
factor	1	index	6	labour	1	occur	1	project	4
feature	2	indicate	1	layer	3	odd	10	promote	4
federal	6	individual	1	lecture	6	offset	8	proportion	3
fee	6	induce	8	legal	1	ongoing	10	prospect	8
file	7	inevitable	8	legislate	1	option	4	protocol	9
final	2	infer	7	levy	10	orient	5	psychology	5
finance	1	infrastructure	8	liberal	5	outcome	3	publication	7
finite	7	inherent	9	licence	5	output	4	publish	3
flexible	6	inhibit	6	likewise	10	overall	4	purchase	2
fluctuate	8	initial	3	link	3	overlap	9	pursue	5
focus	2	initiate	6	locate	3	overseas	6	qualitative	9
format	9	injure	2	logic	5	panel	10	quote	7
formula	1	innovate	7	maintain	2	paradigm	7	radical	8
forthcoming	10	input	6	major	1	paragraph	8	random	8
foundation	7	insert	7	manipulate	8	parallel	4	range	2
found	9	insight	9	manual	9	parameter	4	ratio	5
framework	3	inspect	8	margin	5	participate	2	rational	6
function	1	instance	3	mature	9	partner	3	react	3
fund	3	institute	2	maximise	3	passive	9	recover	6
fundamental	5	instruct	6	mechanism	4	perceive	2	refine	9
furthermore	6	integral	9	media	7	percent	1	regime	4
gender	6	integrate	4	mediate	9	period	1	region	2
generate	5	integrity	10	medical	5	persist	10	register	3
generation	5	intelligence	6	medium	9	perspective	5	regulate	2
globe	7	intense	8	mental	5	phase	4	reinforce	8
goal	4	interact	3	method	1	phenomenon	7	reject	5
grade	7	intermediate	9	migrate	6	philosophy	3	relax	9
grant	4	institute	2	military	9	physical	3	release	7
guarantee	7	instruct	6	minimal	9	plus	8	relevant	2
guideline	8	integral	9	minimise	8	policy	1	reluctance	10
hence	4	integrate	4	minimum	6	portion	9	rely	3
hierarchy	7	integrity	10	ministry	6	pose	10	remove	3
highlight	8	intelligence	6	minor	3	positive	2	require	1
hypothesis	4	intense	8	mode	7	potential	2	research	1
identical	7	interact	3	modify	5	practitioner	8	reside	2
identify	1	intermediate	9	monitor	5	precede	6	resolve	4
ideology	7	internal	4	motive	6	precise	5	resource	2
ignorance	6	interpret	1	mutual	9	predict	4	respond	1
illustrate	3	interval	6	negate	3	predominant	8	restore	8
image	5	intervene	7	network	5	preliminary	9	restrain	9
immigrate	3	intrinsic	10	neutral	6	presume	6	restrict	2
impact	2	invest	2	nevertheless	6	previous	2	retain	4
implement	4	investigate	4	nonetheless	10	primary	2	reveal	6
implicate	4	invoke	10	norm	9	prime	5	revenue	5

reverse	7	site	2	successor	7	theme	8	utilise	6
revise	8	so-called	10	sufficient	3	theory	1	valid	3
revolution	9	sole	7	sum	4	thereby	8	vary	1
role	1	somewhat	7	summary	4	thesis	7	vehicle	8
route	9	source	1	supplement	9	topic	7	version	5
scenario	9	specific	1	survey	2	trace	6	via	8
schedule	8	specify	3	survive	7	tradition	2	violate	9
scheme	3	sphere	9	suspend	9	transfer	2	virtual	8
scope	6	stable	5	sustain	5	transform	6	visible	7
section	1	statistic	4	symbol	5	transit	5	vision	9
sector	1	status	4	tape	6	transmit	7	visual	8
secure	2	straightforward	10	target	5	transport	6	volume	3
seek	2	strategy	2	task	3	trend	5	voluntary	7
select	2	stress	4	team	9	trigger	9	welfare	5
sequence	3	structure	1	technical	3	ultimate	7	whereas	5
series	4	style	5	technique	3	undergo	10	whereby	10
sex	3	submit	7	technology	3	underlie	6	widespread	8
shift	3	subordinate	9	temporary	9	undertake	4		
significant	1	subsequent	4	tense	8	uniform	8		
similar	1	subsidy	6	terminate	8	unify	9		
simulate	7	substitute	5	text	2	unique	7		

Appendix 3

SKELETON PHRASES

Methods

The method of the investigation / inquiry is …

The most common method for … is …

The method of research depends on …

The method proposed in this article is …

The proposed method allows us to solve the problem of …

(The principle of) the method consists in …

The advantage of this method lies in the fact that …

The method can be applied to …

The simplest way of solving this problem lies in …

This is one of the ways …

Unit 4. Results

We saw / observed / were able to see / failed to see…
It was found / detected that …
Notable / rather interesting / of importance are …
N presents / represents…
N turned out to be …
N is presented in Figure 1
The patterns of N distribution are depicted in Figures 2, 4, 7-8
The diagram (Fig. 2) summarizes the main findings of the study.
Figure 1 shows …
As shown in Fig. 3…
Ns are summarized in Table 1.

Table 1 lists …

(See Fig. 1)

There was … relationship.

A great / a large / an increased number of Ns was seen in …

N is frequently (not infrequently) present in …

The (an overwhelming) majority of Ns were …

Ns were rarely / occasionally / infrequently encountered in …

No Ns were found /seen / encountered / detected in …

N is missing / lacking

N varied apparently / significantly

High level of N characterizes …

The parameters of N were assessed according to a method of …

A typical /characteristic feature of N is …

Ns were arranged centrally / peripherally / in a random fashion

N technique was used to estimate …

Spatial distribution /The arrangement of Ns was …

N is located / situated above / below / near …

N was compared with / to …

In comparison with / to N, M has proved to be quite different in …

N was identical to M

N differs from M

Unlike M, N is …

Data for … were compared using the N method

Introduction. Move 1a

The increasing interest in … has heightened the need for …

Of particular interest and complexity are … (*инверсия, обратный порядок слов*)

Recently, there has been growing interest in …

The possibility of … has generated wide interest in …

The development of … is a classic problem in …

The development of … has led to the hope that …

The … has become a favourite topic for analysis …

Knowledge of … has a great importance for …

The study of … has become an important aspect of …

A central issue in … is …

The … has been extensively studied in recent years.

Many investigators have recently turned to …

The relationship between … has been investigated by many researchers.

Many recent studies have focused on ….

Introduction. Move 1b

There is a vast literature on …
This question has been widely discussed in the literature.
It is now well /generally / widely known that …
It is now established that …
It has been long recognized that …
In the past five years considerable information has been accumulated on …
(Very) little is known about …
Much less is known about …
Much less information is available about /on …
No information is available on …
Data / evidence / information are / is not yet available.
The study performed by N et al. …
The possibility of …was raised in … by N.
The assessments were done as previously described.

Introduction. Move 2

CONTRAST

The research has tended to focus on …, rather than on …

These studies have emphasized …, as opposed to …

Although considerable research has been devoted to …, rather less attention has been paid to …

However, it remains unclear whether …

It would thus be of interest to learn how …

If these results could be confirmed, they would provide strong evidence for …

The findings suggest that this approach might be less effective when …

It would seem, therefore, that further investigations are needed in order to …

EXTENDING

These recent developments in … clearly have considerable potential. In this paper, we demonstrate …

The literature shows that … is a useful technique for … . This paper uses … to …

Such … eliminate the need for any … . This paper utilizes the *N* approach for …

Introduction. Move 3

The aim of the present paper is to give … .

This paper reports on the results obtained … .

In this paper we give preliminary results for … .

The main purpose of the experiment reported here was to … .

This study was designed to evaluate … .

The aim of the present paper is to give … .

This paper reports on the results obtained … .

In this paper we give preliminary results for … .

The present work extends the use of the last model by … .

We now report the interaction between … .

The primary focus of this paper is on … .

The aim of this investigation was to test … .

Our primary objective was to test … .

Discussion

To begin with, our results / findings / data demonstrate / show / suggest / indicate that … .

The data presented in this study indicate that … .

The results obtained (in the present investigation) demonstrate that … .

All procedures / The experiments / Our trials yielded positive / negative results as to / concerning … .

We conclude, therefore, that … .

It is concluded from the present study that … .

In conclusion … .

A second (third, etc.) conclusion that can be derived / drawn / deduced from the present investigation is that … .

From these observations the following conclusions / points were /have been made / derived / deduced / drawn. First, … /on the one hand , … . Second, … / On the other hand, … / Then, … / Besides, … / Furthermore, … . Third, … / At last, … / Ultimately, … / Finally, … .

It appears, therefore, that … .

It is clear from these data that … .

Abstract

The aim of the present paper is to give … .
This paper outlines / proposes / describes / presents *a new approach to ...*

This paper examines / seeks to address / focuses on / discusses / investigates *how to solve ...*
This paper is an overview of / a review of / a report on / a preliminary attempt to …

The present paper aims to validate / call into question / refute *N's findings regarding ...*

The aim of our work / research / study / analysis *was to* further / extend / widen / broaden *current knowledge of…*
The aim of the research was thus / therefore / consequently *to*

The aim of this study is to study / evaluate / validate / determine / examine / analyze / calculate / estimate / formulate ...
We describe / present / consider / analyze *a* novel / simple / radical / interesting *solution for ...*

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Учебное издание

Толстова Татьяна Витальевна

**НАУЧНАЯ СТАТЬЯ НА АНГЛИЙСКОМ ЯЗЫКЕ:
СТРУКТУРА И ЭЛЕМЕНТЫ**

Учебное пособие

Редактор Н.С. Куприянова
Компьютерная верстка И.И. Спиридоновой

Подписано в печать 21.04.2019. Формат 60 × 84 1/16.
Бумага офсетная. Печ. л. 7,0
Тираж 300 экз. (1 з-д 30). Заказ №58.

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ АВТОНОМНОЕ
ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ
«САМАРСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
УНИВЕРСИТЕТ ИМЕНИ АКАДЕМИКА С.П. КОРОЛЕВА»
(САМАРСКИЙ УНИВЕРСИТЕТ)
443086, САМАРА, МОСКОВСКОЕ ШОССЕ, 34.

Изд-во Самарского университета.
443086, Самара, Московское шоссе, 34.