

Children who used positioning typically associated this method with immobility or restricting movement, as one 12-year-old girl described after undergoing an appendectomy.

"I have attempted to determine the best possible position to be in . . . either on my side or in a crouched position. I have tried to be without moving so that it would not hurt more."
(15)

All children reported using at least one self-initiated pain relieving method. The majority of them claimed to use four of these strategies during their hospitalization. The mean number of strategies identified was 3.8 with a range from 1 to 8.

Copyright Elsevier. Used with permission.

TASK TWENTY

Produce a Results section from your own work (or part of a Results section if your work is extensive).

Table 2. Children's Self-Initiated Use of Pain Relieving Methods after Surgery

"How have you tried to manage pain/what have you done to help yourself when you had pain?"

	N	%
Distraction	51	98
Resting/sleeping	42	81
Positioning/immobility	27	52
Asking for pain medications/help from nurses	27	52
Imagery	16	31
Walking/moving/doing exercises	11	21
Just being and trying to tolerate pain	10	19
Eating/drinking	6	12
Relaxation	4	8
Thought-stopping	1	2
Breathing technique	1	2
Thermal regulation (cold application)	1	2

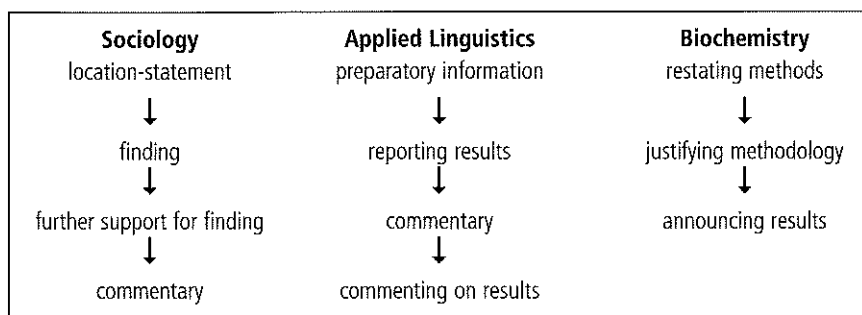
The most common methods of distraction by which the children tried to focus their attention away from pain included reading, watching TV/videos, and playing games. For example, a 10-year-old boy described his experiences as follows.

"I have read Donald Duck comics . . . this helps me forget the pain. I can also get my thoughts elsewhere by playing Nintendo games. When I concentrate on playing I don't have much time to think about anything else." (7)

Another method of drawing attention away from pain included the use of imagery in which the children reported thinking about some pleasant action/happening (e.g., getting home), important people (e.g., mother/father, friends), or pets in order to forget the pain. The method of thought-stopping was used by only one child. A 12-year-old boy described this method as follows without utilizing specific replacement thoughts.

"Then I have kept on thinking that I am not hurting, there is no pain, there is no pain." (11)

FIGURE 15. Outline of Results Sections in Three Fields



It is useful to note the following.

1. Brett's research shows that *further support* will likely include comparisons and/or examples.
2. Yang and Allison's results indicate that *preparatory information* includes reminders and connectors between sections, location statements, and previews.
3. Typically, there are more result statements than comments. Often two or three result statements are followed by a comment statement.
4. Typically, the components shown in the figure are recycled; sometimes a complete cycle constitutes a paragraph and then the cycle begins again.
5. Typically, the major findings are presented before the more minor ones.

TASK NINETEEN

Here we provide the first of four Results subsections from the article on children's pain entitled "Hospitalized Children's Descriptions of Their Experiences with Postsurgical Pain Relieving Methods."

The authors, Pölkki, Pietilä, and Vehviläinen-Julkunen, are from Finland and conducted the study in a hospital there. Suppose this was a draft, can you offer some suggestions for improving the text?

5. Results

5.1 Children's self-initiated use of pain relieving methods

The children reported 13 successful types of self-initiated pain relieving methods. As shown in Table 2, most of the children reported using distraction, resting/sleeping, positioning/immobility and asking for pain medication or help from nurses when they experienced pain.

The Organization of Results Sections

Longer Results sections may have subsections. Some subsections may simply reflect the different stages or parts of the investigation. Consider the case of an article published in the *International Journal of Nursing Studies* entitled "Hospitalized Children's Descriptions of Their Experiences with Postsurgical Pain Relieving Methods." This article, which we will be exploring more closely later, has four subsections in the results.

5. Results

5.1 *Children's self-initiated use of pain relieving methods*

5.2 *Nurses' use of pain relieving methods*

5.3 *Parents' use of pain relieving methods*

5.4 *Children's suggestions to nurses and parents*

However, in another article from the same journal (entitled "Inflammatory Bowel Disease: Developing a Short Disease Specific Scale to Measure Health Related Quality of Life"), the subsections are very different.

3. Results

3.1 *Disease specificity*

3.2 *Factor analysis*

3.3 *Reliability*

3.4 *Validity*

Doubtless, in all fields the specifics of the investigation (including the methodology adopted) will determine subsection headings (if any). However, beyond that, the available research suggests that there are some regularities in the organization of Results sections. We present summaries of studies in Sociology (Brett, 1994), Applied Linguistics (Yang and Allison, 2003), and Biochemistry (Kanoksilapatham, 2005) in Figure 15.

TASK EIGHTEEN

Complete one of these tasks. Discuss your findings in class.

1. Carefully read a fairly short Results section that you have written, marking any commentary elements. In your estimation, which of the four types is the section most like?
2. Choose Results sections from three to five of the papers in your reference collection and determine which of the four types they most closely resemble.

Type 1

Gives a straightforward description of the author's results; includes no commentary at all (no comparisons with the work of others, no justifications, no—or very few—obvious highlighting statements).

Type 2

Is mostly restricted to present findings but includes a few minor uses of commentary.

Type 3

Consists of both description of findings and a number of commentary elements; uses several of the categories mentioned by Thompson.

Type 4

Makes heavy use of commentary; uses most of the categories found by Thompson; could almost be taken for a discussion.

TASK SEVENTEEN

Which of Thompson's types are acceptable in a Results section, or do you think the category is better placed in the Discussion section? If acceptable for Results, write R; if it is better for Discussion, write D.

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

Table 24 presents Thompson's research (1993) on Results sections.

TABLE 24. Commentary Found in Results Sections in Biochemistry Papers

Type of Commentary	Number of Papers (max. = 20)
Justifying the methodology	19
Interpreting the results	19
Citing agreement with previous studies	11
Commenting on the data	10
Admitting difficulties in interpretation	8
Pointing out discrepancies	4
Calling for further research	0

As can be seen, the first four types of commentary were used by half or more than half of her authors; indeed, only the Calling for Further Research category was universally postponed to the Discussion. Here is part of Thompson's conclusion.

My research demonstrates that scientists—in this case biochemists—do not present results only in a factual expository manner; they also employ a variety of rhetorical moves to argue for the validity of scientific facts and knowledge claims. (126)

How did your responses to Task Seventeen match Thompson's findings?

Commentary in Results Sections

The question of whether the Results section should include commentary—and of what kind—is not easy to answer. In fact, you will find different answers in different writing manuals; further, you may get different views from your instructors, advisors, and supervisors. The more traditional view is that the Results section of an RP should simply report the data that has been collected; that is, it should focus exclusively on simply describing the actual results and should do so using the past tense. Another view would accept some interpretation of results but would suggest that more wide-ranging observations should be left until the Discussion or Conclusions. A third view accepts the fact that authors often include commentary in their Results section because they are aware of their audience. They can *anticipate* that their readers may be thinking, “Why did they use this method rather than that one?” or “Isn’t this result rather strange?” For obvious reasons, authors may not want to postpone responding to such imagined questions and critical comments until the final section.

The issue is further complicated by the type of material expected in the final section. In some disciplines, the Discussion section will be extensive and may be the longest section of the RP (as is often the case in medical research, and sometimes the case in the areas of Social Psychology and Education). Elsewhere, the final section may provide little more than a summary conclusion. Because of this uncertainty, it is not surprising that some researchers prefer to offer a combined Results and Discussion section. Bruce (2009) notes that this is a trend in leading chemistry journals, and we have noticed a similar trend in Applied Linguistics.

In a pioneering paper, Dorothy Thompson, herself a biochemist, investigated whether Biochemistry articles contained various types of commentary in their Results sections (Thompson, 1993).

TASK SIXTEEN

Complete the alternative formulations. Make some complex statements similar to those in the examples discussed in the Language Focus section.

1. Group A produced 15% fewer errors than Group B but required one-third more time to complete the task.

Group B _____
_____.

2. Thailand exported 8.8 million metric tons of rice, while India exported 2.2 million metric tons.

The amount of rice exported by Thailand was _____
_____.

3. Sweden consumed 328,000 barrels of oil daily. In contrast, Spain consumed 1,482,000 barrels of oil each day.

The number of barrels of oil consumed by Spain was _____
_____.

4. The 1958 tsunami that occurred in Lituya Bay, Alaska, reached a height of 524 meters, but there were only two recorded casualties. However, the 2004 Indian Ocean tsunami, which reached 100 meters, killed over 230,000 people in fourteen countries.

The height of the Lituya Bay tsunami was _____
_____.

The death toll of the Indian Ocean tsunami was _____
_____.

more than X times _____ *-er than that of* _____

The density of water is more than 800 times greater than that of air.

The potency of this compound is more than 1000 times greater than that of previously reported inhibitors of the enzyme.

Here are some other ways that authors can signal similarity/equivalence and difference/non-equivalence.

Sentence connectors	Since the six phases of emergency measures were implemented, SO ₂ concentrations have dropped a significant 33% to 80µg/m ³ ; <i>however</i> , PM10 concentrations decreased just 8% to 162µg/m ³ .
Subordinators	Analyses showed that 70.5% of students had access to both a desktop and a laptop computer, <i>while</i> only 0.6 % of students (n = 11) had access to neither.
Phrase linkers	<i>In contrast to</i> the false positives, the false negative rate improves when the distance threshold increases.
Conjunctions	The results of some observers were poor, <i>but</i> those of others were satisfactory (Table 5).
<i>More likely than/less likely than</i>	Women are <i>more likely than</i> men to have given the most "pro neighborhood" answer, and men <i>more likely than</i> women to have given the most "pro transportation" answer.
<i>Like</i>	The results shown in Figure 8 are very much <i>like</i> those of Experiment 5.
<i>Alike</i>	During the study period, real household income rose in both cities and suburbs <i>alike</i> , but more so among suburban households.
<i>Similar to/the same as</i>	The observation of smaller magnetization and coercivity at low thickness <i>is similar to</i> results obtained for the Fe ₃ O ₄ thin films.
Verbs such as <i>compared with/compared to</i>	Women had a mean score of 3.89, <i>compared with</i> a mean for men of 4.76.

Another type of complex comparison involves *as much* _____ *as* and *as many* _____ *as* expressions, as in these examples.

China produces *four times as many engineers as* the United States does.

The nanoscale TBs impart *as much strengthening as* conventional high-angle GBs by blocking dislocation motion.

Here are a few more potentially useful ways to make comparisons.

X times the _____ *of* _____ *as* _____

Women typically require twice the dosage of morphine as men to achieve the same degree of pain relief.

Turfgrass is the main cultivated crop in Florida with nearly four times the acreage as the next largest crop, citrus.

more/less than X times the _____ *of* _____ *as* _____

The paired metal chlorides yield more than three times the amount of product than the CuCl_2 catalyst (Fig. 2).

Greece consumes more than double/more than two times the amount of cheese as Denmark.

more/less than X times the _____ *of* _____

The alkaline phosphatase level is usually less than two times the upper limit of normal.

The guarana seed contains more than two times the caffeine of a coffee bean.

more than X times _____ *-er than the* _____ *of* _____

Each year, the average probability of dying from motor vehicle accidents in France was more than 12 times higher than the risk of drowning.

Although any country can implement smoke-free laws, the proportion of high-income countries with smoke-free restaurants (12 of 41 or 29%) is more than three times higher than the proportion of low- and middle-income countries with similar measures (12 of 139 or 9%).



Language Focus: Making Comparisons

When writing up the results, you may want to include statements of comparison. The street crossing text included a number of statements that compared the different outcomes of the experiments. Here is one such example.

Conversing on a cell phone produced significantly lower success rates than listening to music ($p < 0.01$).

This example is a fairly straightforward comparison. Sometimes, however, the comparisons can be more complex and thus require some careful attention. For instance, we can start with this sentence.

The median wage of a college graduate is *now higher than* the median wage of a high school graduate.

For stylistic reasons, we may then opt to not repeat *the median wage* and instead use *that*.

The median wage of a college graduate is *now higher than that* of a high school graduate.

To make matters more complex, we may know roughly how much higher the wage of college graduates is and then produce this sentence.

The median wage of a college graduate is *now more than 70 percent higher than that* of a high school graduate.

We can then include a hedging element.

The median wage of a college graduate is *now slightly more than 70 percent higher than that* of a high school graduate.

Although the final sentence is rather complex, the basic form of this sentence looks something like this.

_____ is (more than %) _____ *-er* (comparative adjective form)
than that of _____.

TASK FIFTEEN

Fill in the blank with *was* or *were*.

1. A total of 45 undergraduates from a single introductory psychology course _____ recruited for the study.
2. The average score of all the results _____ 69.4%.
3. Well over half of the participants _____ unable to accurately estimate their logical reasoning ability relative to their peers.
4. Nearly 95 percent of the participants _____ unable to estimate how many questions they answered correctly.
5. Approximately 90 percent of the bottom-quartile participants _____ unaware of that their perceptions of ability were grossly out of line with their true ability.
6. One-quarter of the participants who scored in the bottom quartile _____ less able to gauge the competence of others than were their top-quartile counterparts.

Another interesting grammar point arises in sentences beginning with *a . . . number of / the . . . number of*. Which form of *be* would you choose here?

A small number of high performing students _____ able to predict their test scores.

The small number of student errors _____ attributable to their solid preparation.

3. *Time*—At least at first sight, your results here may be perplexing. Which three disciplines might you expect to be the top three?
 4. *Work*—What do you think are the three disciplines that use *work* the most?
 5. *Life*—Neither Biology nor Nursing has the highest frequency for *life*. Which field do you think might use this noun the most?
 6. *Should*—This modal auxiliary is used to express obligation or requirement. In your opinion, what field might use this word most frequently?
-



Language Focus: Special Verb Agreements

This sentence follows the standard rule whereby the verb agrees with the subject noun (in this case *set*) and not the second noun (in this case *questionnaires*).

A set of 200 questionnaires was distributed.

Note that this important rule does not apply in a few exceptional cases, such as when the first noun is a fraction, a proportion, or a percentage. In these special cases, the verb agrees with the noun closest to the verb. Notice the agreement of the subject and verb in these sentences.

A large proportion of students are distracted when they cross a street while talking on the phone.

Only a minority of the cells were alive four hours after antibody administration.

A small fraction of the emitters were contributing significantly to the overall emission current from the array.

times per 10k in IOE, Mech. Eng. and Econ., respectively. All the other disciplines fell between these two extremes.

- B. We next turn to a more technical word *data*, as shown in Table 23. Here we find the expected skewed distribution, with almost no occurrences in the humanities and the highest counts in IOE and Mech. Eng. Interestingly, the figures for CEE are much lower, being below those for biology, education, and nursing. We have no explanation for this finding at the present time. Also, the frequency for linguistics suggests it is not a humanities discipline, although it is often classified as such.
- C. The results for *data* are shown in Table 23. The results broadly reflect how "technical" a discipline tends to be. Frequencies are, on average, highest in engineering and science, lowest in the humanities, with the social sciences falling in the middle. Exceptions to this overall finding are the relatively low frequency for physics (6.3 per 10,000 words) and the high numbers for economics (16.2 per 10,000). In the former case, it should be borne in mind that much of physics is highly theoretical; in the latter, that economics has become much more mathematical in recent decades.

As it turned out, the MICUSP results for *data* are much what we might have expected. Others are not so easy to predict.

Write up your own results for Table 23, selecting, if you like, parts from A, B, and C.

TASK FOURTEEN

What might you expect to be the results for the following searches in MICUSP?

1. *Language*—It is no surprise that linguistics would have the highest frequency among the 16 disciplines. But which disciplines might be second and third?
2. *If*—This is a common function word; as such it might be expected to have a fairly even distribution. However, the average use of *if* in one of the sixteen disciplines is much higher than that of the other disciplines. Which one is it?

Some very different results are shown in Table 23. They come from a simple search in MICUSP. The search totaled all occurrences of the word *data* in each of the 16 disciplines covered. Overall, the word *data* occurred 1,901 times in 324 papers (out of total of 830). The results for each discipline have been normalized for 10,000 words so that comparisons can be made.

TABLE 23. Search Results for the Word *Data* in MICUSP

Discipline	Frequency per 10,000 Words
Biology	14.4
Civil/Environmental Engineering (CEE)	8.6
Economics	16.2
Education	7.0
English	0.0
History	0.1
Industrial/Operations Engineering (IOE)	21.8
Linguistics	9.0
Mechanical Engineering	8.2
Natural Resources & the Environment (NRE)	4.4
Nursing	12.6
Philosophy	0.5
Physics	6.3
Political Science	3.8
Psychology	3.3
Sociology	5.1

TASK THIRTEEN

Now read these three versions of a partial write-up of the results for this search. What are the strengths and weaknesses of each? What do you like and not like? Discuss with a partner.

- A. Table 23 shows the search results for the noun *data*. It occurred 1,901 times in 324 out of the 830 papers collected in the Michigan Corpus of Upper-level Student Papers (MICUSP). In other words, it was found in fewer than half of the papers. In some fields, it occurred hardly at all, these disciplines being English, history, and philosophy. On the other hand, it occurred 21.8, 18.2 and 16.2

As can be seen, Pattern B was the most frequent. At this juncture, it should be noted that in Pattern B the reference to the non-verbal material is more grammatically prominent because it is placed as the subject of the clause, while in the other three cases the prominence is reduced because they occur in a prepositional phrase (A), in parentheses (C), or in a subordinate clause (D). Our preliminary hypothesis, therefore, is that in an essentially language-oriented discipline like Discourse Analysis, location statements will be downplayed, producing larger proportions of patterns like C. On the other hand, in Engineering, with its stress on figures and calculations, there may well be an understandable preference for Pattern B.

In undertaking this small research project, we also discovered some other useful tendencies. First, although individual authors—or groups of authors—obviously had their preferences, all varied their location statements; in fact, all the Engineering author groups used at least four of the five patterns. Second, there was a tendency to use “stronger” statements (A and B) in the earlier parts of their papers and “weaker” ones (C and D) later. Third, there was some preference for placing Pattern D (e.g., *as shown in Table 3*) at the end of the sentence rather than the beginning.

TASK TWELVE

Take your small collection of research articles from your own field, and scan them for location statements, coding them as done in Tables 21 and 22. Make a table and write up your results; include comparisons with Tables 21 and 22 as appropriate. Finally, consider whether or not your results support our preliminary hypothesis.

We reviewed 20 recent articles from a journal in our own field, *English for Specific Purposes: An International Journal*, to find out which patterns were more common. Two of the articles made no reference to non-verbal material; in the remaining 18, 76 references were found (averaging 3.8 per paper), ranging from a minimum of one to a maximum of 11. The results are shown in Table 21.

TABLE 21. Location Statements in *English for Specific Purposes*

Pattern A (. . . are shown in Table 3)	22
Pattern B (Table 3 shows . . .)	29
Pattern C (see table 3)	9
Pattern D (As shown in Table 3,)	13
Pattern E (other)	3
Total	76

Of the four main patterns, Pattern B was the most common and Pattern C the least common.

We next turned to a very different field to compare our results and chose a journal called *Computer-aided Civil and Infrastructure Engineering*. As might be expected, location statements were more frequent in these articles because they contained much more visual material. We examined recent articles until we collected a total of 100 location statements (this amounted to six articles). The results are shown in Table 22.

TABLE 22. Location Statements in *Computer-aided Civil & Infrastructure Engineering*

Pattern A	22
Pattern B	33
Pattern C	22
Pattern D	15
Pattern E	8
Total	100

suggest that the simulated environment or task was unduly hazardous. Pilot data collected in preparation for the current study (identical task but with vehicles traveling at a constant speed and distance from each other), moreover, found similar effects of distraction, even when the crossing task was substantially easier. In the pilot testing, parameters for car movement and density allowed participants to successfully cross the road 99% of the time in the no distraction and music listening conditions, success rates far higher than observed in the present study. Nonetheless, successful crossing rates declined in the cell phone condition, falling to 97% (differences not significant), resulting in a pattern of data that was somewhat similar to that which we report in the current study.

[The remainder of the Discussion section has been omitted.]

Copyright Elsevier. Used with permission.

As Task Eleven indicates, Discussion sections differ from Results sections in that the Discussion section explains why the results are meaningful in relation to previous, related work and the research question that was explored. More on this can be found in Unit Eight.

When reading the street crossing text, you might have noticed two important characteristics of the Results sections: the use of location statements and comparative language.



Language Focus: Another Look at Location Statements

This Language Focus section further investigates references to non-verbal material (tables, graphs, figures, photographs, etc.). There are four patterns here.

Pattern A	The high rates are shown in Table 3.
Pattern B	Table 3 shows the high rates.
Pattern C	The rates were high (see Table 3) or (Table 3) or (shown in Table 3).
Pattern D	The rates were high, as shown in Table 3. As shown in Table 3, the rates were high.
Pattern E (other, not A–D)	The results, given in Table 3, show the high rates. Figure 3 is a photograph of the bridge.

Table 2. Mean Overall Trial Duration(s), Crossing Success Rates, Collision Rates, and Rate of Errors from Time Outs

	Trial Duration	Success Rate	Collision Rate	Time Out Rate
No distraction	11.73 (0.62)	83.85 (1.81)	14.49 (1.73)	1.65 (0.47)
Cell phone	13.27 (0.52)	80.20 (2.32)	15.45 (2.03)	4.34 (1.01)
iPod	11.47 (0.57)	84.98 (1.83)	13.67 (1.60)	1.65 (0.56)

Note: Values in parentheses indicate one standard error of the mean.

[The remainder of the Results section has been omitted.]

4. Discussion

Field studies (e.g., [Hatfield and Murphy, 2007] and [Nasar et al., 2008]) have observed that pedestrians make more unsafe street crossings when conversing on a cell phone than when undistracted. Our findings provide partial experimental confirmation of these observations. Participants were less likely to successfully cross the street in our task when they were conversing on a cell phone than when they were listening to music on an iPod. Furthermore, engaging in a cell phone conversation while crossing the street led to higher time out rates in our virtual street-crossing task than did listening to music or performing the task undistracted. Additionally, participants took more time to initiate a crossing when conversing on a cell phone, and walked more slowly during crossing. The last result is consistent with data from field studies of pedestrian street crossing that have observed slower walking during cell phone conversations (e.g., [Hatfield and Murphy, 2007] and [Nasar et al., 2008]).

The fact that our successful crossing rates were somewhat low (one would certainly hope that in the real-world pedestrians successfully cross the street more than 84% of the time) might suggest that our task was artificially difficult, and hence not representative of the real world. As noted, though, most of the failures to cross successfully were the result of the trial timing out, not the result of collision. The low rate of successful crossing, therefore, does not

TASK ELEVEN

Here are parts of the Results (Section 3.1) and Discussion sections (Section 4) of an article reporting on how divided attention affects a pedestrian's ability to safely cross a busy street. The study was conducted in a simulator where students walked on a treadmill. While crossing a virtual street, students were distracted by a cell phone conversation or by listening to music on an MP3 player. What significant ways do the texts in the two sections differ? In what ways are they similar? Create a list highlighting your findings.

Pedestrians, Vehicles, and Cell Phones

Neider, M. B., McCarley, J. S., Crowell, J. A.,
Kaczmariski, H., and Kramer, A. F. (2010).
Accident Analysis & Prevention, 42, 589–594.

3.1. Crossing success rate

Is the likelihood of safely crossing a street influenced by the number or types of tasks a pedestrian is concurrently engaged in? To answer this question we analyzed the percentage of trials in which observers successfully crossed the road (Table 2). If listening to music or conversing on a cell phone impaired performance, then we would expect success rates in those conditions to be lower than in the no distraction condition. An ANOVA performed with distraction as a within-subjects factor partially confirmed this prediction, $F(2,70)=3.96$, $p<0.05$, $\eta_p^2 = 0.1$. Participants crossed successfully approximately 84% of the time when undistracted and nearly 85% of the time when listening to music, compared to 80% of the time when talking on a cell phone; listening to music induced no performance cost relative to the no distraction condition ($p = 0.53$). Conversing on a cell phone produced significantly lower success rates than listening to music ($p < 0.01$). Participants trended towards poorer performance when conversing on a cell phone compared to the no distraction condition, but the post hoc comparison did not reach significance ($p = 0.09$).

figures. Results, on the other hand, are “statements in the main text that summarize or explain what the data show” (Annesley, 2010, 1067). Data can be manipulated to obtain a result. A result is a message that can, for instance, give readers a sense of whether one value is higher or lower than another or some data differs from other data in some significant way. A result is supported by data (Wright et al., 1999). Here are two examples of results statements that are derived from data.

After 80 visits, bees visited iridescent disks *more frequently than* after their immediate introduction to the arena [first 10 visits = 4.7 ± 0.5 (mean \pm SE); last 10 visits = 8.1 ± 0.4 ; Student's t-test, $t(9) = 4.96$, $P < 0.001$] (Fig. 4B).

The surface morphology at 65°C (Fig. 5(h)–(j)) *was smoother than* that at 35°C and 55°C (Fig. 5(e)–(g)).

Results versus Discussion

Another important consideration is the difference between results and discussion. As you may know, many guidelines for writing the Results section specify that this section should present only results and include no interpretation or discussion. If, however, you have ever tried to strictly adhere to this, you know it is hard to avoid commenting on the results as you present them. This, of course, is not a problem if you are writing for a journal that combines Results and Discussion sections. However, when Results and Discussion are separate sections, a major challenge is determining what to include in each, what level of generality is appropriate for each, and what type of commentary works best in each. To help with this, we turn to Task Eleven.

TASK TEN

Choose one task to complete.

1. Mei-Lan's advisor says, "This is good, but I am afraid your draft is too long; it's nearly 150 words. 100 words would be much better. Can you shorten it, focusing more on what you did?" Edit Mei-Lan's draft for her.
 2. Write (or re-write) your Methods section for some of your own research.
 3. Alternatively, write up your method for how you created your reference collection of articles.
-

Results Sections

The other section we deal with in this unit is the Results section. As we will see, this section has much in common with the material that was covered in the unit on data commentary (Unit Four). Many of the concepts discussed there are directly relevant, such as

- using location statements
- rounding numbers and making generalized comparisons
- judging the right strength of claim
- highlighting key findings from the data

Before revisiting some of these concepts, we first need to explore the difference between *data* and *results*.

Data versus Results

To begin, although we often use the terms *data* and *results* interchangeably, they are, in fact different (Annesley, 2010). This distinction is important because novice writers may include data in the Results section but fail to provide results, which may lead to a negative evaluation of a study. Data consists of facts and numbers, and these are generally presented in tables and

Writing Up a Methods Section

Task Nineteen in Unit Three (page 136) included an interview with a student planning her first research paper for her master's in social work. Mei-Lan's research was on Chinese elderly living in the United States. She had chosen this topic because of some "prevailing myths" that the Chinese communities would always look after their elderly and that such elderly would not accept help from outsiders. She further noted that all the research to date had been conducted in the large Chinese communities in big cities on the east and west coasts and that therefore it would be useful to study smaller communities in the midwest. She was then asked her about her methodology. Re-read the interview transcript.

Later, Mei-Lan and her advisor decided to attend a regional panel discussion on research into elderly minorities in the midwest. For this, they were required to circulate a 500-word summary of their research beforehand. Mei-Lan was given the task of writing up the Methods section. This is her draft.

Semi-structured interviews were employed to investigate current relationships between elderly Chinese and their immediate families. The study-site consisted of three small communities in the American midwest because the available research on this topic has been restricted to the larger communities on the east and west coasts (Yang & Yang, 2007; Olsen & Chang, 2009). Ten elderly Chinese were interviewed. These interviews were conducted on a one-on-one basis (i.e., without the presence of family members who might have impeded the interviewees from expressing their true feelings). Interviews usually lasted about an hour and were conducted in the interviewees' preferred language. Although questions had been prepared in advance by the interviewer, they were not always followed in strict order or in their entirety. On occasion, the conversations moved into new and unexpected territory and so produced new information. Prior IRB permission was obtained for the procedures.

Frequency of Purpose Clause Types and Verbs

In the Hyland corpus of research articles (80,000 words from 80 research articles in Biology, Physics, Electrical Engineering, Mechanical Engineering, Marketing, Applied Linguistics, Sociology, and Philosophy), the two most common verbs to occur in initial purpose clauses are *determine* and *test*; these are followed by a closely clustered group of six: *avoid*, *establish*, *illustrate*, *obtain*, *reduce*, and *understand*. Overall, sentence-initial *to* + verb is about three times more common than *in order to* + verb.

Placement of Purpose Clauses

First, if the purpose clause is essentially metadiscoursal, it needs to be placed first.

To clarify matters, there appear to be five different approaches

....

To phrase it somewhat differently, one can define

Otherwise, the decision partly depends on the length of the main clause. So, we might have a choice between these two sentences.

Contrastive analysis of written discourse in itself will not be sufficient to answer these questions.

To answer these questions, contrastive analysis of written discourse in itself will not be sufficient.

However, in the next case, only initial position seems possible.

To answer this question, we may draw upon a data set of 4,689 rural "events," episodes in which some collectivity openly seized or damaged the resources of another party or defended themselves against another party's claims upon them that took place between June 1, 1788, and June 30, 1793.

Rationale behind Purpose Clause Use

We suspect that initial purpose clauses are on the increase. After all, if you give your reasons for a decision before stating the decision itself, your reader may be less likely to question that decision, as in "Why did they do that?"

It is also possible to include cognitive and volitional verbs in order to reveal the thinking behind the procedural decisions:

The first approach *was considered*, and consequently dismissed. It *was thought* that this method would increase the likelihood of ambiguity and error (for example, there may be more than one political party with the title of The Labour Party).

Here we provide a few more linking phrases that operate to tie sections together and to add some stylistic variety. We have divided them into three groups. How many of these can you turn into complete sentences?

A. Initial Purposive Clauses or Phrases

1. *In an effort to evaluate*
2. *In order to establish*
3. *To further test this hypothesis,*
4. *To determine the cost,*
5. *In the interest of obtaining useful data,*

B. Phrases making temporal links

1. *During the data collection,*
2. *Prior to collecting this information,*
3. *On arrival on campus, the participants*
4. *In the follow-up phase of the study, we*
5. *After the interview, subjects were*

C. Causal or connective phrases

1. *Based on the feedback from the pilot study,*
2. *On the basis of the literature review,*
3. *Because of privacy issues, we*
4. *In spite of these issues, we*
5. *In light of these unexpected findings,*

Although research is still ongoing, we are beginning to get an idea of how fields might differ in terms of the condensed-to-extended continuum, as shown in Table 20. Do you agree?

TABLE 20. Disciplinary Variation in Methods Section

Condensed	Intermediate	Extended
Chemistry Materials Science Mycology Molecular Biology	Public Health Political Science Systematic Botany Medical Research	Psychology Sociology Education Applied Linguistics

However, it should be noted that the Methods section will probably need to be more extensive if any of these conditions apply.

- The paper is aimed at a multidisciplinary audience.
- The methods chosen are new or controversial.
- The paper is essentially a “methods paper.”



Language Focus: Linking Phrases in Methods Sections

It is common in academic writing for purpose statements to occur at the beginnings of sentences, as shown in these examples.

To detect groups among the specimens . . . , we used

To avoid weighting characters, we excluded

Another way to avoid monotony is to use linking phrases related to time.

Before conducting the analysis, we

After incubating for 48 hours, the cells were harvested and analyzed.

You may also consider adding a linking phrase to justify a step in the methodology.

Based on previous reports of HR mutations in APL, we performed direct DNA sequencing analysis.

Because of its hygroscopic properties, the dye was stored and handled in ethanol solution.

Samples

⑩ The U.S. one hundred-dollar bill was chosen as the primary focus of this study because it represents the largest value on the counterfeit market. ⑪ Therefore, one control group included genuine \$100 Federal Reserve Notes from the printing series 1996 and later ($n = 10$). ⑫ Additional control groups included \$50 Federal Reserve Notes ($n = 5$, Series 1996–2004), \$20 Federal Reserve Notes ($n = 5$, Series 1996–2006), and \$1 Federal Reserve Notes ($n = 54$, Series 1999–2006) in order to test for fluorescence lifetime variations between banknote denominations. ⑬ All control samples were genuine Federal Reserve Notes, in circulation, non-sequential, and untreated prior to lifetime measurements.

⑭ Three types of known counterfeits were tested in these experiments: 1. Copies made by digitally scanning a bill into a computer followed by printing on both sides using a consumer-grade color inkjet or laser printer (herein referred to as “digital”). 2. Traditional counterfeits made with a cotton and linen blend and printed using more sophisticated methods. ⑮ These bills are often produced by foreign organized crime groups (herein referred to as “traditional”). 3. Bleached (or “washed”) bills made by removing the ink from a lower denomination bill and then reprinting a larger denomination over the ink-less paper (herein referred to as “bleached”). ⑯ Three counterfeit bills of each type were tested. ⑰ Fluorescence lifetime measurements were also obtained from several control materials. ⑱ These include printer paper made from wood pulp, 100% cotton stationary paper, and swatches of 100% linen cloth.

Counterfeit Money Detection by Intrinsic Fluorescence Lifetime

Levene, M. J., and Chia, T. (2010).

Lasers and Electro-Optics (CLEO) and

Quantum Electronics and Laser Science Conference (QELS),

2010 Conference on Laser Electro-Optics: Applications, 1–2, 16–21.

2. Methods

Microscope Apparatus

① We used a custom-built two-photon microscope based on an Olympus BX51 WI upright fluorescence microscope (Olympus America, Center Valley, PA). ② The excitation wavelength was set to 735 nm with a 100 fs pulsewidth. ③ The microscope objective was a 4x, 0.28 NA air objective (Olympus, XLFLUOR 4x/340, Olympus). ④ Samples were held flat on a motorized 3-axis microscope stage (ASI Imaging, Eugene, OR). ⑤ Fluorescence lifetime capabilities were made possible through the addition of a multi-channel plate PMT (R3809U-52, Hamamatsu) and a time-correlated single photon counting (TCSPC) card (SPC-150, Becker & Hickl, Berlin, Germany). ⑥ The fluorescence was filtered through a 555 nm short-pass filter (Chroma Technologies, Rockingham, VT). ⑦ A fluorescence lifetime decay curve was produced by raster scanning the laser beam over a 4 mm² area (or frame) and summing the emission photons for 60 seconds (~0.8 seconds/frame). ⑧ Fluorescence lifetime decays, $F(t)$, for genuine Federal Reserve Notes were fit to the two-component lifetime model (Eq. (1)),

$$F(t) = a_1 e^{t/\tau_1} + a_2 e^{t/\tau_2} \quad (1)$$

by obtaining the best X^2 fit value. ⑨ Counterfeit samples were fit to either a one-component or two-component model depending on its X^2 fit value.

TASK NINE

Looking again at the Methods description in Task Eight, would you say it is condensed, extended, or somewhere in between? Now look at these two extracts from Methods sections. Would you say they were condensed, extended, or somewhere in between? How did you decide?

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. Methodology

The ASTM C127 and C128 procedures were followed to determine the density, specific gravity, and absorption capacity of the fine and course aggregate. To determine the gradation of the candidate Michigan aggregate, dried fine and coarse samples were analyzed using the ASTM C136 method. To determine the unit weight of the candidate Michigan coarse aggregate sample, the ASTM C29 procedure was followed.

MICUSP. CEE. GO.02.1

Read the next Methods section from a paper proposing an approach to identifying genuine and counterfeit currency. Discuss with a partner where it lies on the continuum from condensed to extended.

arising in the readers' minds. Given the amount of information, we can consider this type of description as *extended*.

On occasion, we may also find cognitive verbs (e.g., *believe*) and/or volitional verbs (e.g., *wanted to*) used in a Methods section to explain or justify more of the thinking behind the procedures, as in this somewhat extreme example (italics added):

The corpus for this study was constructed *with a number of aims in mind*. Given the preliminary nature of the topic, *we wanted to* cover a fairly wide range of fields (or disciplines) in order to gauge the extent of the phenomenon. *We also felt it prudent* to include among the fields those which we guessed would have some use of imperatives, such as statistics . . . geology *We eventually settled on* the following:

Swales et al., 1998.

In effect, *condensed* methods state what the researchers did with little elaboration or justification. *Extended* methods present readers with a rationale of why and how researchers did what they did. You can elaborate your Methods by

- providing useful background knowledge (e.g., through definitions and examples).
- using descriptions of procedural steps, rather than citations and/or acronyms.
- including a number of justifications (e.g., *To determine this value, we . . .*).
- using cognitive or volitional verbs (e.g., *We believed*, *We wanted to*).
- including *by + -ing + verb + how* statements (*This was done by reversing the order*).
- employing a wide range of linking words and phrases (e.g., time expressions, such as *next* or *prior to*).

If your methods are fairly standard you may

- assume readers have relevant background knowledge.
- sometimes use citations or acronyms to refer to processes (e.g., *A corpus was designed following Römer (2010)*).
- have few justifications.
- use few or no cognitive or volitional verbs.
- choose to avoid *by + -ing + verb + how* statements.
- employ few linking phrases.

sections contain some accounting for procedures. However, how this is done will vary, largely according to discipline. At one extreme, descriptive Methods sections may look like this extract from a MICUSP research paper.

DNA was extracted from tissue and feather samples using the Qiagen DNeasy Extraction kit. An addition of dithiothreitol was used for samples from feathers. Polymerase chain reaction (PCR) was carried out using two primers pairs for cytochrome B (CytB; Sorenson et al., 1999). PCR and sequencing was done following protocols in Mindell et al. (1997).

MICUSP File BIO.G2.04.1

As you can see, the extract contains nothing but descriptive statements, consistently using the past passive. There is no chronology here, no use of personal pronouns, and no explanations or justifications for the procedure. Also, notice that the fourth sentence concludes with *was done following protocols in Mindell et al.* Naming procedures by citation (rather than describing them) only seems possible in fields with well-established and standardized procedures, as in some of the hard sciences. We can consider this type of description as abbreviated or condensed.

Now compare the Biology extract with this one from Botany. (We have added bold, italics, and underlining to bring out its features.)

To detect groups among the specimens and extract the variables that best diagnose the groups, we used principal 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.

We can see here something very different. First, the three authors have adopted the *we* form to describe their procedures. Second, they have added a temporal phrase (underlined) at the beginning of the second sentence and a clarifying phrase at the opening of the third. Third and most importantly, the first and fourth sentences begin with *to* + verb purposive clauses (bolded) that explain and justify the chosen procedures. Such initial clauses have typically an additional rationale; they work to prevent questions and objections

3. Do you think the sample scenarios are needed? Should the authors have described how the final sample was derived?
 4. How is the information organized? What subheadings could you add to help readers? Where would you place them?
 5. What verb tense dominates? Why did the authors choose this tense? Could another tense have been chosen?
 6. How do the authors maintain a good flow of ideas in the first paragraph? Do they follow this same strategy in the final paragraph?
 7. Does active or passive voice dominate? Why is this the case?
 8. What verb tense (past or present) and voice (active or passive) dominates in the Methods sections of the papers that you analyzed? Why?
 9. You have been asked to lead a discussion focusing on the method used in this paper. What points would you make?
 10. Analyze 3–5 papers from your reference collection in terms of the move structure in the Methods sections. Are the moves the same as those proposed by Peacock or are there others?
-

Variation in Methods Sections

We have already mentioned that Methods sections can be quite variable in terms of moves and level of detail. Whether the methods are described in considerable detail depends on the type of study being done. Junior scholars are sometimes tempted to over-explain their methods, including information that had little or no bearing on the results. A good rule of thumb is to include steps or procedures that if omitted would cause the experiment or study to fail (Annesley, 2010). The extent to which you describe those steps or procedures depends very much on whether the detail is needed for readers to understand what you did and to perhaps replicate your work. Standard methods may require only a reference plus any modification to the method.

Another consideration has to do with author positioning. How widely acceptable are your methods? To what extent do you need to clarify, explain, and perhaps justify what you did? How much do you need to do to convince your readers that your procedures are appropriate and reasonable? Because of these factors, some Methods sections may be more *condensed*, while others may be more *extended*. According to Peacock's research (Table 19) all Methods

the goods (victims) were an individual; an organisation or society.

13 Two examples of scenarios were:

14 "In the days following the Tsunami in Indonesia, isolated places have a food scarcity. 15 Ragu has no food to feed his family. 16 He has been approached by black market dealers who have offered him food in exchange for money. 17 Considering the food has been procured from the burglary of a private home, how acceptable do you think it is for Ragu to buy such food?" (survival need, individual victim).

18 "Michael is a student with a passion for music who has been approached and offered state of the art electronic stereo equipment at half the price it sells for in the local stores.

19 Assuming that Michael could not otherwise afford such equipment, and that he is aware that the goods have been stolen from a large international electronic manufacturer, how acceptable do you think it is for Michael to buy such equipment?" (cannot afford need, organisation victim).

20 Half the questionnaires included scenarios in which all the consumers were depicted as male while in the other half they were always female. 21 The only difference between these two questionnaires was the implied gender of the names and the pronouns used. 22 The order of presentation of the scenarios was varied across participants. 23 Finally, a demographic section asked participants their age, gender, occupation and income.

Copyright Elsevier. Used with permission.

1. Which of the moves described in Table 19 can you find in the method description?
2. Do you think the level of detail is sufficient or insufficient? In other words, is there enough information to allow the study to be adapted or replicated by others? If not, what would you need to know?

Now that we have discussed several aspects of Methods sections, it is time to read and critique one.

TASK EIGHT

Here is the Methods section from a paper investigating hypothetical consumer behavior in buying stolen, pirated, or counterfeit goods from the black market. Read it and then answer the questions on pages 294–295.

Consumer Decisions in the Black Market for Stolen or Counterfeit Goods

Casola, L., Kemp, S., and Mackenzie, A. (2009).
Journal of Economic Psychology, 30, 162–171.

Method

- ① A total of 80 (36 male) participants were recruited at the University of Canterbury (51 participants) and from the general population (29 participants).
- ② Participants from the general public were recruited in four different malls of the local city, representing four different socio-economic levels as indicated by land values.
- ③ The overall age range was between 15 and 68 years of age, with a mean of 27 ($SD = 13$).
- ④ All participants completed the same questionnaire.
- ⑤ The final sample contained 53 current students and 27 non-students.
- ⑥ All participants were given two \$1 "scratch-and-win" lottery tickets in recognition of their help.
- ⑦ The bulk of the questionnaire consisted of nine black market scenarios.
- ⑧ Participants were asked to rate each scenario in terms of how unacceptable they perceived it was for the agent in the scenario to make a purchase from the black market.
- ⑨ Participants circled a value between 1 and 7 on a rating scale where a score of 1 corresponded to "completely acceptable," a score of 4 was "reasonably acceptable," and a score of 7 was "not at all acceptable."
- ⑩ The nine scenarios varied (3×3) the need of the agent and the original source of the goods offered in the market.
- ⑪ The need of the agent could be survival; a need to save money; or not otherwise being able to afford the good.
- ⑫ The original sources of

It is important to keep in mind that the moves do not necessarily appear in the order given. In fact, some cycling of moves, particularly materials and procedure, is common in the science fields investigated. In the remaining fields, the move cycle structure may be much more complex and variable. We can see the frequency of the moves in Table 19.

TABLE 19. Frequency of Appearance of Individual Moves: Interdisciplinary Differences (% in which the moves appear)

Moves	Biology	Chemistry	Physics	Environmental Science	Business	Language and Linguistics	Law	Public and Social Administration
Subjects or materials	97	100	75	31	92	94	86	86
Location	36	8	0	67	47	58	58	75
Procedure	100	100	100	100	100	100	100	100
Data analysis	86	100	67	78	72	67	56	50
Limitations	6	0	0	69	44	19	28	6
Research aims or questions/hypotheses	3	0	6	11	36	22	58	67
Overview	3	0	0	50	25	19	42	54

Based on Peacock, 2011.

TASK SEVEN

Discuss these questions about Table 19 with a partner.

1. How might you explain the different percentages for location?
2. Why do you think methods in the sciences do not generally include overviews?
3. Which field, would you say, is most similar to Business in terms of Methods sections?
4. In four fields, limitations were given in less than 10% of the methods. Is this because there were no limitations? Or is there another possible reason?
5. What surprises you most about the table?

- ____ 9. In my field, Methods sections typically include references to other studies.
- ____ 10. I should mainly use past tense in my Methods section.

If you and your partner are from different disciplines, you may have disagreed on some of the points in Task Six.

Although Methods sections have been somewhat under-researched compared to other parts of RPs, especially Introductions, some interesting disciplinary differences have been highlighted in recent research. For instance, Peacock (2011) examined 288 RP Methods sections in published, data-driven papers from the fields of Biology, Chemistry, Physics, Environmental Science, Business, Language and Linguistics, Law, and Public and Social Administration (36 papers from each field). He proposed the existence of seven “moves” in Methods sections. Simply put, a *move* is a stretch of text with a specific communicative function. Moves are a matter of rhetoric. This concept is addressed in more detail in Unit Eight.

Move

Overview	a short summary of the research method, at or near the beginning of the Methods section
Research aims, questions, or hypotheses	a description of the research goals, the questions to be answered, or the hypotheses
Subjects and/or materials	in Business, Language and Linguistics, Law, and Public and Social Administration, a description of the people (groups of people) in the study; and in the sciences, a description of the materials, equipment, and so on
Location	a description of where the research took place and possibly why
Procedure	a discussion of the process used to obtain the data that was collected
Limitations	a focus on a shortcoming of the method, possibly accompanied by an explanation
Data Analysis	a description of how the data was analyzed

Adapted from Peacock, 2011.

Sponsorship? Inclusion criteria?). In some journals, Methods sections are printed in smaller fonts and perhaps placed at the end; in others, they are given the same typographical treatment as the other sections. Finally, as we have seen, in some fields Methods sections are closely examined; in others, especially when standard procedures were used, they may receive less attention. This is especially true when the methods are well known and when a simple reference may be sufficient, as in these examples.

To identify duplicate gene pairs, we followed the method of Gu et al. (2002a).

We used the method of surface grating decay [10] to measure surface diffusion on a model organic glass.

Reverse transcription reactions were performed according to the manufacturer's protocol.

TASK SIX

Work with a partner and decide which of the statements apply to the writing of a Methods section. Write A if you agree or a D if you disagree. If you are unsure, indicate this with a question mark (?).

- _____ 1. My Methods section should provide information that helps readers understand how and why my experiments or research was done.
- _____ 2. I should include information that would allow other researchers to reproduce my study and obtain largely similar results.
- _____ 3. I should describe methods that are standard in my field.
- _____ 4. My Methods section should make it easy for readers to understand and interpret my results.
- _____ 5. I should write my Methods section in a manner that allows readers to conclude that my results are valid.
- _____ 6. My Methods section should constitute a substantial portion of my paper.
- _____ 7. I should provide justifications for my choice of methods.
- _____ 8. I should discuss the limitations of my method in the Methods section.

Methods Sections

You might have expected us to begin our discussion of RP sections with the Introduction. Instead, we are beginning with the Methods section because this is the section that authors tend to write first. They do this because, in terms of content, it is rather clear what to include. Even so, graduate students often express considerable anxiety about their research methods, especially if qualitative studies are involved. Barton (2002) notes that another source of graduate student anxiety is that the published accounts of Methods sections look perfect, typically because authors avoid discussing what did not work. Finally, reviewers, supervisors, editors, and examiners pay particular attention to Methods sections. A good methodology leads to the expectation that the results will also be good. These two quotations, the first from medical research and the second from Education, demonstrate the importance of the Methods section.

If an abstract is of interest, the editor next looks at the methods section of the manuscript before deciding whether to reject the paper or pass it on to the screening editor on duty for that day. The screening editor decides whether the manuscript should be sent for external review.

—E. Langdon-Neuner, 2008, 84

As a reviewer I may find an opening theoretical gambit to be compelling, but if I can't reconstruct the author's means of collecting, reducing and analyzing data, then I will have little faith that the construction of results follows responsible and consistent treatment of evidence and will not likely recommend the paper for publication.

—P. Smagorinsky, 2008, 48

As we will see, there are disciplinary differences in Methods sections; even the heading *Methods* is not always used, as when authors use *The Study* as their section heading or *Materials and Methods*. In some fields, it is common to have subsections in Methods that might deal with materials, the apparatus used, definitions employed, the subjects or participants in the study, or the statistical procedures used. Methods also vary according to how much information and explanation they contain. At one extreme, they may be very condensed; at the other, elaborately extended. Disciplines vary in what needs to be included (Equipment? Statistics? Manufacturers? Sources? Permissions?

TASK FIVE

Read the eight sentences from a MICUSP research paper from the field of Industrial and Operational Engineering. The paper about a stress ball—a ball made of rubber or a rubber-like substance that is squeezed either to relieve stress or to exercise the muscles in the hand. Can you determine from which of the four sections the sentences come? Mark each one I, M, R, or D. There are two from each section. Work with a partner.

- ___ 1. Representative height, weight, comfortable and maximum grip strength values for the participants in terms of means and standard deviations are shown in Table 1.
 - ___ 2. The test stimuli in this study were the protocols, or instructions for collecting data, that were used in each of the measurement stations.
 - ___ 3. Anthropometry is a technique for measuring the human body in terms of dimensions, proportions, and ratios.
 - ___ 4. It should be noted that the recommended dimensions would generate a stress ball that would be best for the study participants, but not necessarily for the larger populations.
 - ___ 5. If no data is obtained or measurements are inaccurate, products may be designed in such a way that they are either unsafe or unpractical, which most likely would lead to a decrease in sales.
 - ___ 6. Men participants also had a comfortable grip strength 1.25 kg larger than the women and had a maximum grip strength 8.25 kg larger than the women.
 - ___ 7. The results of this study might be challenged on the basis that the population tested was small and not random (all participants enrolled in the same course).
 - ___ 8. Next, the participants visited the grip strength station, which was equipped with a Takei grip dynamometer, to measure their comfortable and maximum grip strength.
-

TABLE 18. Frequencies of Selected Features in RP Sections

	Introduction	Methods	Results	Discussion
Present tense	high	low	low	high
Past tense	mid	high	high	mid
Present perfect	mid	low	low	mid
Passive	low	high	variable	variable
Citations	high	low	variable	high
Hedges	mid	low	mid	high
Evaluative comments	high	low	variable	high

As you can see, there are some similarities between the Introduction and Discussion, on the one hand, and between Methods and Results, on the other. This may suggest a pattern of more “concrete” inner sections and more “conceptual” opening and closing sections.

With a partner, discuss the features of RPs in your field. Would you rate the frequency of the features as high, variable, or low in each of the sections? Use the chart below.

Analyze 3–5 papers in your reference collection (or more, if you have time) to determine whether your perceptions were correct or correspond to Table 18. If possible, add another feature of your own to the final row.

	Introduction			Methods			Results			Discussion		
	High	Low	Variable	High	Low	Variable	High	Low	Variable	High	Low	Variable
Present tense	x					x						
Past tense												
Present perfect												
Passive												
Hedges												
Boosters*												
Citations												
Evaluative comments												
One of your own												

*Boosters consist of language that is chosen to add strength to a claim. They allow authors to indicate a strong conviction to a claim. Examples include *clearly*, *obviously*, and *of course*.

We assume that you will be using a typical organizational pattern for your paper—in other words, the IMRD format or some variant of it. Fortunately, many of the units deal with topics that are relevant for this purpose, as shown in this list.

<u>Research Paper Parts</u>	<u>Relevant Topics Covered</u>
Title	Unit Eight: Titles
Abstract	Unit Five: Summary writing Unit Eight: Abstracts
Introduction	Unit Two: General-specific Unit Three: Problem-solution Unit Six: Critiques
Methods	Unit Three: Process descriptions
Results	Unit Four: Location statements Unit Four: Highlighting statements Unit Four: Qualifications
Discussion	Unit Four: Explanations Unit Five: Summaries
Acknowledgments	Unit Eight: Acknowledgments
References	(not dealt with in this book)

As a result of the different purposes given in the box on page 285, the four sections have taken on different linguistic characteristics. We explore some of these linguistic characteristics in this next task.

TASK FOUR

Table 18 shows how the frequencies of selected linguistic features can vary from one section to another. For example, we would normally expect the present tense to appear regularly in the Introduction and Discussion sections, but, depending on the field or type of study, not to be a major tense in the other two sections. Review Table 18 and then do the task.

FIGURE 14. Overall Shape of a Research Paper

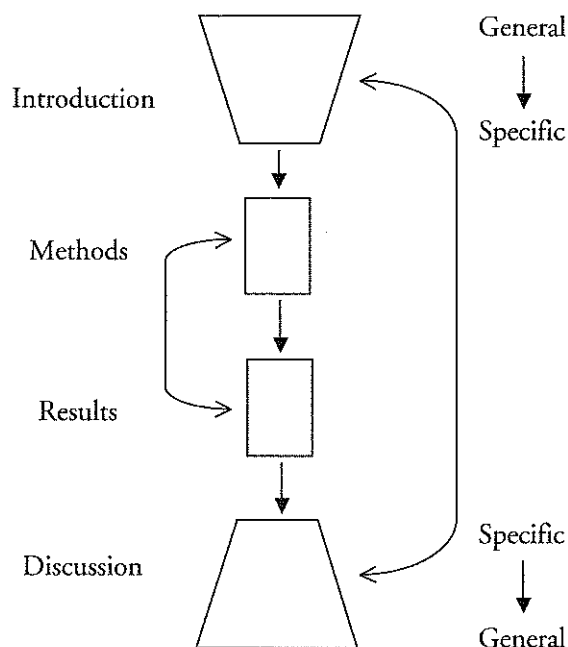


Figure 14 gives a useful indication of the broad-narrow-broad or general-specific-general movement of the typical RP. As the RP in English has developed over the last hundred years or so, the four different sections have become identified with four different purposes.

Introduction (I)	The main purpose of the Introduction is to provide the rationale for the paper, moving from a general discussion of the topic to the particular question, issue, or hypothesis being investigated. A secondary purpose is to attract interest in the topic—and hence readers.
Methods (M)	The Methods section describes, in various degrees of detail, methodology, materials (or subjects), and procedures. This is the narrowest part of the RP.
Results (R)	In the Results section, the findings are described, accompanied by variable amounts of commentary.
Discussion (D)	The Discussion section gives meaning to and interprets the results in a variety of ways. Authors make a series of "points," at least some of which refer to statements made in the Introduction.

Longer Research Papers

When you read an RP, you may think that it is a fairly straightforward account of an investigation. Indeed, RPs are often designed to create this impression so that authors can appear more convincing to their readers. However, we believe that such impressions are largely misleading and may lead novice authors to conclude that writing up research should be an uncomplicated process for those with some experience. A more accurate picture is that RP authors typically operate in a highly competitive environment. They need to establish that their research questions are sufficiently interesting for others to read. They need to demonstrate that they are familiar with the relevant literature to demonstrate that the research questions have not already been answered. And they need to compete against other RPs for acceptance and recognition. As a result, RP authors are very much concerned with positioning—with showing that their studies are relevant and make some new contribution to the field.

The overall rhetorical shape of a typical RP is shown in Figure 14. The arrows indicate that the sections are closely connected. In fact, some journal editors have suggested that authors try to create a strong connection between the Introduction and Discussion. In addition, authors should make sure that every method described is related to some results and all results are related to a method.

Some empirical papers will follow a slightly different pattern in which the Results and Discussion sections appear in the same section. This eliminates the difficult task of deciding in which section authors should interpret or give meaning to their results. In other types of papers, several studies may be discussed, which results in some cycling of the Methods-Results-Discussions sections. Despite these and other variations, the basic format remains relevant.

3. One typical feature of many field SCs, including this one, is that the authors discuss their findings cautiously. For example, on only two occasions do the authors make a claim about their discovery. One occurs at the end of Paragraph 1 where the authors write . . . *badger presence had not been confirmed in* What is the other one?
 4. The SC has no subsections, but its five paragraphs have a clear structure. What is the focus of each?
Paragraph 1: _____
Paragraph 2: _____
Paragraph 3: _____
Paragraph 4: _____
Paragraph 5: _____
 5. Would you describe the organization as problem-solution, general-specific, or something else?
 6. What is your reaction to the title? Does it seem appropriate for the text? Can you think of any way to improve it?
 7. Do you think the conclusion is reasonable based on the information provided? Why or why not?
 8. How important is it to give the measurements in both U.S. and metric units?
 9. Do you think the authors are amateurs with an interest in Biology or trained biologists? Does this matter? How might you find out?
 10. Because of the heavy use of the passive, we do not know which of the authors actually trapped the badger. Does this matter? The paper also does not explicitly say that the captured badger was a female. Why? Is there any information that could have been included to help readers understand?
 11. If you work or partly work in a discipline that requires field-work, does this SC look familiar or not? If not, what might be differences, and why?
 12. If you were interested in knowing whether this piece has ever been cited, how would you go about finding this information?
-

12 Six radio telemetry locations were obtained through September 2004 (Fig. 2). 13 The badger occupied an area within and adjacent to PRNL's Inland Buffer Zone, 1.9-2.5 miles (3-4 km) southeast of Beaver lake. 14 Mean daily movements were 1.1 ± 0.6 miles (1.7 ± 1.0 km) (SD). 15 Little comparative data is available; 16 however, badgers have reportedly traveled up to 8.8 miles (14 km) in 4 hr (Hoodicoff 2002). 17 Female and male badgers have dispersed up to 40 and 73.8 miles (64 and 118 km), respectively (Messick, 1987).

18 Although this is the first verified record of a North American Badger at PRNL, badgers have probably occupied areas within PRNL previously. 19 Badgers have been reported in Alger County south of PRNL on the adjacent Hiawatha National Forest (K. Doran, Hiawatha National Forest, personal communication). 20 Additional surveys to document badger distribution and abundance within PRNL and adjacent areas are warranted.

Literature Cited

- Baker, R. H. 1983. *Michigan Mammals*. East Lansing: Michigan State University Press.
- Belant, J. L. 2004. Field immobilization of raccoons (*Procyon lotor*) with Xelazol and Xylazine. *Journal of Wildlife Diseases* 40: 786-789.
- Hoodicoff, L. W. 2002. Landscape movements and conservation of badgers (*Taxidea taxus*) in British Columbia, Canada. Society of Conservation Biology 16th Annual Meeting, Canterbury, United Kingdom. (abstract).
- Long, C. A. 1973. *Taxidea taxus*. *Mammalian species* 26. The American Society of Mammalogists, Lawrence, Kansas.
- Messick, J. P. 1987. North American Badger. Pages 587-597 in (Novak, M., J. A. Baker, M. E. Obbard, and B. Malloch, eds). *Wild Furbearer Management and Conservation in North America*. Ottawa: Ontario Trappers Association and Ontario Ministry of Natural Resources.
- Whitaker, J. O. Jr., and W. J. Hamilton, Jr. 1998. *Mammals of the Eastern United States*. Ithaca: Cornell University Press.

Copyright Michigan Audubon. Used with permission.

1. What is the purpose of this SC? Who is the audience?
2. What stylistic features indicate that this is a piece of academic writing?

TASK THREE

Read the passage and discuss the questions on pages 282–283 with a partner. We have numbered independent clauses as sentences for ease of discussion.

Occurrence of a Badger in Pictured Rocks National Lakeshore, Michigan

Belant, J. L., Wolford, J. E., and
Kainulainen, L. G. (2007).

Michigan Birds and Natural History, 14(2), 41–44.

① North American Badgers (*Taxidea taxus*) occur throughout the western United States and Great Plains of North America, with the geographic range extending east to central Ohio (Messick, 1987; Whitaker and Hamilton, 1998). ② In Michigan, badgers have been verified in all counties, including those in the Upper Peninsula (Baker, 1983). ③ However, badger presence had not been confirmed in the Pictured Rocks National Lakeshore (PNRL), located in Alger County, northcentral Upper Peninsula, Michigan.

④ On 16 September 2004, a badger was captured adjacent to PNRL (lat 46032'N, long 86019'W), incidentally in a cage trap (Model 108, Tomahawk Live Trap Company, Tomahawk, WI), during a study of American Marten. ⑤ The badger was immobilized using an intramuscular injection of Telazol® (Fort Dodge Animal Health, Fort Dodge, IA) with basic physiology monitored as described by Belant (2004). ⑥ The badger received a radio transmitter (Advanced Telemetry Systems, Isanti, MN); ⑦ standard body metrics were taken.

⑧ A tooth was not extracted for aging; ⑨ however, measurements including body length 25 inches (64 cm), total length 30 inches (76 cm), skull length 4.7 inches (12.0 cm), skull width 3.5 inches (9.0 cm), and estimated weight 13 pounds (6 kg) suggested that this individual was probably a yearling (Long, 1973; Baker, 1983; Messick, 1987). ⑩ Teeth were not damaged and evidence of staining was not observed. ⑪ Nipple size (2 < mm length or width) and coloration suggested this badger had not produced young.

In fact, most SCs published today in the hard sciences, Engineering, and Medicine now take the form of short articles. In other words, they follow the IMRD format and include an abstract. Indeed, even medical case reports are increasingly taking this form because most today include a comprehensive literature review. Typically, these mini-articles run three to six printed pages. Given their similarity to longer empirical RPs, much of what we have to say about IMRD articles in Units Seven and Eight will apply to SCs as well. However, there is one type of SC that is rather different; this is illustrated in the next section.

Short Communications (SCs) in Disciplines that Report Fieldwork

This type of research communication is widespread but is mostly found in local, regional, or national journals. SCs of this type are part of the writing tradition in disciplines that are engaged in field research³ (e.g., Biology, Archaeology, and Geology) and in such areas as Linguistics, Folklore, Local History, Architecture, and Ethnomusicology.

A principal function of many of these SCs is to report on a rare or unusual phenomenon, whether it is a rare rock formation, dialectal usage, or organism of some kind. In effect, SCs are used for reportable discoveries, and they have a history that extends back to the original founding of scientific journals in England and France in the seventeenth century. The example in Task Three is taken from a small regional journal called *Michigan Birds and Natural History*. This journal is refereed and appears four times a year. It contains many SCs. The topic of this SC is a badger, a mid-sized nocturnal mammal.

³ Research based on firsthand observations made outside a controlled experimental setting such as a laboratory.

the same results. Systematic reviews, unlike review articles, generally follow the IMRD pattern. Increasingly, in many graduate programs, students are expected to write systematic reviews. Even if you are not expected to write a systematic review, keep in mind that state-of-the-art papers, whether systematic or not, are invaluable since they provide an in-depth overview of the important literature of a field and a snapshot of where the field is at a particular moment.

According to Noguchi's (2001) study of 25 review articles published in the *Proceedings of the National Academy of Sciences*, such pieces are likely to have a primary focus of one of these four types.

Focus	Aim
History	Presenting a historical view of (part of) the field
Current work	Describing the current state of knowledge
Theory/model	Proposing a theory or model to account for the available data
Issue	Calling attention to an important issue in the field

TASK TWO

Read a review article of relevance to you. Does it include one of the aspects proposed by Noguchi? Or is the approach different? What kind of section headings does it have? How long is it? How many references does it have?

There are a few other types of text published in journals. Book reviews (addressed in Unit Six) are found in many journals. Another type of journal publication consists of comments on or responses to published papers. These are not found in all fields but are fairly common in psychology and medical journals. Such critiques were also covered, at least in part, in Unit Six. Then there are editorials in which an editor or invited author makes a case for his or her perspective on an issue, often concluding that a field needs to reassess priorities and directions. Finally, we have *short communications* (also called *brief reports* or *technical notes*) and standard empirical research papers. The main focus of these last two units will be on the latter, but first we will briefly examine one type of short communication (SC), especially because these, along with book reviews, may be among the first items that junior researchers publish.

Types of Journal Publication

First, it is important to emphasize that not all research articles are empirical. In Astrophysics, for example, experimentation is actually impossible: "One cannot experiment on a star or a galaxy in the way in which one can experiment on a chemical compound or a bean plant" (Tarone et al., 1998, 115). As a result, astrophysicists tend to publish logical argumentation papers that have a general-specific structure (see Unit Two). This form of argument moves typically from known principles to observations, and then to equations designed to account for the observed phenomena. Such papers can be common in Theoretical Physics, in Mathematics, in Theoretical Linguistics, and in fields that rely on computer modeling (e.g., certain areas of Economics, Biostatistics, and Engineering).

Papers that are more theoretically oriented tend to not follow the standard Introduction-Methods-Results-Discussion (IMRD) pattern that is used in many research papers.¹ To compensate for the lack of a fixed IMRD structure, these papers often contain a considerable amount of *metadiscourse* (Unit Four), which "roadmaps" the organization of the paper. Further, because of their theoretical nature, the use of first-person pronouns is more widely accepted. We will not deal with this type of paper in great detail in these last two units; nevertheless, much of what we will discuss still applies.

Another kind of journal publication that we will only briefly mention here is the *review article*, *state-of-the-art paper*, or *meta-analysis*.² Such articles are usually written by senior scholars at the invitation of journal editors. The aim of these invited papers is often to clarify the state of the art in a particular field.

Some review articles, known as *systematic reviews*, follow a very strict method for choosing the research to review in response to a carefully chosen research question. Adhering to the same kind of rigor as would be expected in any other kind of research is thought to prevent bias that could emerge when authors are free to select articles. Moreover, with a transparent methodology in place, others should be able to replicate the work and obtain

¹ These four sections of the research paper are capitalized when we are discussing them in broad terms or offering details about writing them.

² Although the terms *review* and *meta-analysis* are often used interchangeably, they differ in important ways. While a systematic review summarizes literature, a meta-analysis involves combining the results of many separate studies and synthesizing conclusions to determine the effectiveness of a treatment, procedure, or process. Meta-analyses first require a systematic review to be done. However, not all systematic reviews include a meta-analysis.

Unit Seven

Constructing a Research Paper I

Units Seven and Eight consolidate many of the aspects of academic writing that have been stressed in earlier units. However, they also break new ground and differ from the previous units in one important way. At this stage, we think that you may be carrying out research of some kind. The purpose of these units, therefore, is to help prepare you with writing up your own research.

TASK ONE

If you have not done so already, find 5–10 well-written published research papers that are typical of papers in your area of study. It does not matter whether these are seminal papers or where the research was conducted. We simply want you to have a small data set (a corpus) that you can analyze to gain some insights into the important characteristics of published work in your discipline.

Before we delve into the writing of research papers (RPs) and work with your corpus, we need to narrow our focus here somewhat. This narrowing is necessary because we want to draw your attention to types of journal publications other than the traditional empirical research paper, not all of which we have the space to deal with in this book.