Practice of Basic Informatics
[Week 07 Mini Lecture]
-Academic Paper Writing-

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A part of the slides are referred from Simon Peyton Jones.

Paper writing is teaching

- It is useful to think that you are **teaching** your reader your idea
  - What you did
  - Why it's important
  - How it works
- Well-written papers contribute more than just their described results
  - Readers understand the topic better

The Idea

Idea: A re-usable insight, useful to the reader

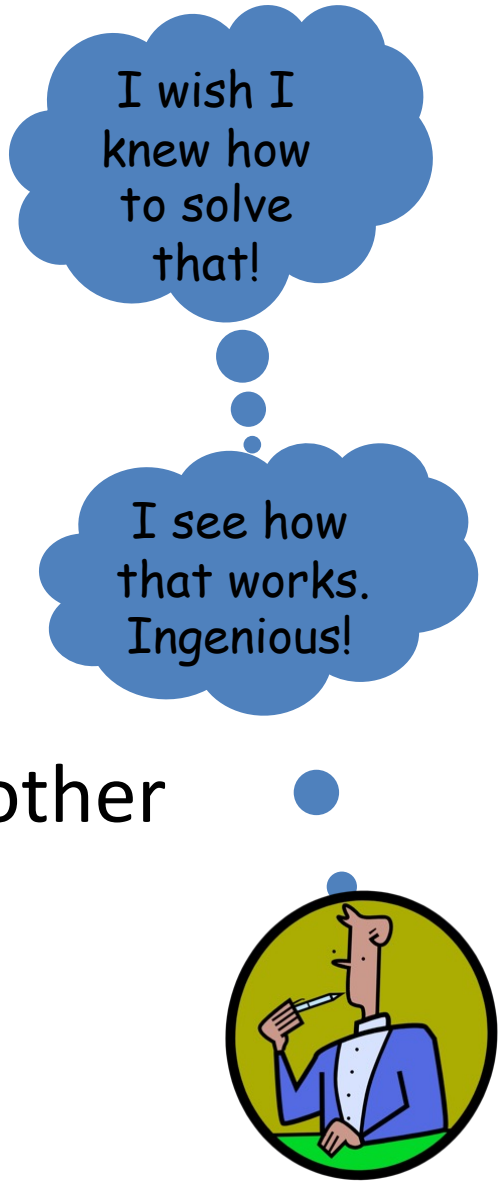
- Figure out what your idea is
- Make certain that the reader is in no doubt what the idea is. Be 100% explicit:
  - "The main idea of this paper is...."
  - "In this section we present the main contributions of the paper."
- Many papers contain good ideas, but do not distil what they are.

One Idea, One Paper

- Your paper should have just one “ping”: one clear, sharp idea
- Read your paper again: can you hear the “ping”?
- You may not know exactly what the ping is when you start writing; but you must know when you finish
- If you have lots of ideas, write lots of papers

Your narrative flow

- Here is a problem
- It's an interesting problem
- It's an unsolved problem
- **Here is my idea**
- My idea works (details, data)
- Here's how my idea compares to other people's approaches



Characterizing your reader

- What do you assume of your reader?
  - Technical knowledge
  - Preconceptions/attitude
  - Interests
- As a proxy, consider the intended venue
  - Who is on the PC? What work do they do?
  - What are the topics and assumptions of papers previously published here?

Structure (conference paper)

- Title (1000 readers)
- Abstract (4 sentences, 100 readers)
- Introduction (1 page, 100 readers)
- The problem (1 page, 10 readers)
- My idea (2 pages, 10 readers)
- The details (5 pages, 3 readers)
- Related work (1-2 pages, 10 readers)
- Conclusions and further work (0.5 pages)

The abstract

- Should be brief, not assume too much, and highlight items of importance
- Four sentences [Kent Beck]
  - State the problem
  - Say why it's an interesting problem
  - Say what your solution achieves
  - Say what follows from your solution
- Remember, the goal is to get the reader to read the introduction …
- I usually write the abstract last

Example

1) Many papers are badly written and hard to understand
2) This is a pity, because their good ideas may go unappreciated
3) Following simple guidelines can dramatically improve the quality of your papers
4) Your work will be used more, and the feedback you get from others will in turn improve your research

Structure

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- **Introduction** (1 page)
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The introduction (1 page)

1) Describe the problem

What is the broader context?

What is the particular problem?

- Why is it interesting?

2) State your contributions

What is new? (novelty)

Why is it useful? (features of your solution)

How do you know? (evaluation)

Assume reader is general attendee of target conference

Describe the problem

1 Introduction

There are two basic ways to implement function application in a higher-order language, when the function is unknown: the *push/enter* model or the *eval/apply* model [11]. To illustrate the difference, consider the higher-order function **zipWith**, which zips together two lists, using a function **k** to combine corresponding list elements:

```
zipWith :: (a->b->c) -> [a] -> [b] -> [c]
zipWith k []     []     = []
zipWith k (x:xs) (y:ys) = k x y : zipWith xs ys
```

Here **k** is an *unknown function*, passed as an argument; global flow analysis aside, the compiler does not know what function **k** is bound to. How should the compiler deal with the call **k x y** in the body of **zipWith**? It can't blithely apply **k** to two arguments, because **k** might in reality take just one argument and compute for a while before returning a function that consumes the next argument; or **k** might take three arguments, so that the result of the **zipWith** is a list of functions.

Use an example to introduce the problem

State your contributions

- Write the list of contributions first
- The list of contributions drives the entire paper: the paper substantiates the claims you have made
- Reader thinks "gosh, if they can really deliver this, that'd be exciting. I'd better read on"
  - Follows style of claim then evidence
    - More on this later

State your contributions

Which of the two is best in practice? The trouble is that the evaluation model has a pervasive effect on the implementation, so it is too much work to implement both and pick the best. Historically, compilers for strict languages (using call-by-value) have tended to use eval/apply, while those for lazy languages (using call-by-need) have often used push/enter, but this is 90% historical accident — either approach will work in both settings. In practice, implementors choose one of the two approaches based on a qualitative assessment of the trade-offs. In this paper we put the choice on a firmer basis:

- We explain precisely what the two models are, in a common notational framework (Section 4). Surprisingly, this has not been done before.
- The choice of evaluation model affects many other design choices in subtle but pervasive ways. We identify and discuss these effects in Sections 5 and 6, and contrast them in Section 7. There are lots of nitty-gritty details here, for which we make no apology — they were far from obvious to us, and articulating these details is one of our main contributions.

  In terms of its impact on compiler and run-time system complexity, eval/apply seems decisively superior, principally because push/enter requires a stack like no other: stack-walking

Bulleted list of contributions

Do not leave the reader to guess what your contributions are!

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Presenting the idea

3. The idea

Consider a bifircuated semi-lattice D, over a hyper-modulated signature S. Suppose p_i is an element of D. Then we know for every such p_i there is an epi-modulus j, such that $p_j < p_i$.

- Sounds impressive...but
- Sends readers to sleep
- In a paper you MUST provide the details, but FIRST convey the idea

Presenting the idea

- Explain it as if you were speaking to someone using a whiteboard
- **Conveying the intuition is primary**, not secondary
- Once your reader has the intuition, he/she can follow the details (but not vice versa)
- Even if he/she skips the details, he/she still takes away something valuable

Putting the reader first

- **Do not** recapitulate your personal journey of discovery. This route may be soaked with your blood, but that is not interesting to the reader.

- Instead, choose the most direct route to the idea.

The payload of your paper

Introduce the problem, and your idea, using

EXAMPLES

and only then present the general case

Using examples

2 Background

To set the scene for this paper, we begin with a brief overview of the *Scrap your boilerplate* approach to generic programming. Suppose that we want to write a function that computes the size of an arbitrary data structure. The basic algorithm is "for each node, add the sizes of the children, and add 1 for the node itself". Here is the entire code for `gsize`:

```
gsize :: Data a => a -> Int
gsize t = 1 + sum (gmapQ gsize t)
```

The type for `gsize` says that it works over any type `a`, provided `a` is a *data* type — that is, that it is an instance of the class `Data`[1] The definition of `gsize` refers to the operation `gmapQ`, which is a method of the `Data` class:

```
class Typeable a => Data a where
  ...other methods of class Data...
  gmapQ :: (forall b. Data b => b -> r) -> a -> [r]
```

Example right away

The Running Example

- Understanding an example is an intellectual investment
  - Make your examples simple enough to understand but still convincing
  - Aim for reuse
- Ideal approach to use an example
  - First concept
  - Example of first concept
  - Next concept
  - Example embellished
  - Next concept followed by more embellishment …

Non-ideal approaches to examples

- First concept
- Next concept
- Next concept
- Example of first concept
- Example embellished
- More embellishment

Leaves reader unsure between concepts

- First concept
- Example of concept
- Next concept
- Different example
- Next concept
- Yet another example

Extra effort to understand each example

The details: evidence

- Your introduction makes claims
- The body of the paper provides **evidence to support each claim**
- Check each claim in the introduction, identify the evidence, and forward-reference it from the claim
- Evidence can be: analysis and comparison, theorems, measurements, case studies

General idea: **Claim then Evidence**

- The claim/evidence structure should occur throughout the paper
  - Top-down, as opposed to bottom-up, organization
- Each section should begin with a claim and/or summary
  - "This section proves that the boobaz approach is sound. To do this …"
  - "This section shows that boobaz performs well under a typical workload. We gathered …"
  - "Boobaz is distinct from other approaches to X primarily in that …"
- Same with subsections, even paragraphs

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Related work

Wrong

To make my work look good, I have to make other people's work look bad

The truth: credit is not like money

Giving credit to others does not diminish the credit you get from your paper

- Warmly acknowledge those who helped you
- Be generous to the competition. “In his inspiring paper [Foo98] Foogle shows.... We develop his foundation in the following ways...”
- Be fair to your own work, too - acknowledge limitations and justify your contributions

Credit is not like money

Failing to give credit to others can kill your paper

If you imply that an idea is yours, and the referee knows it is not, then either

- You don't know that it's an old idea (bad)
- You do know, but are pretending it's yours (very bad)

Big picture: advancing knowledge

- Strive to be precise in your comparisons
- Best: use terminology you have used to explain your approach to explain related approaches. Crystallize the differences.
  - Helps readers, helps you
- Poor: focus on superficial differences between yours and related approaches
  - Inhibits knowledge of the true state of the art
- Discussion of related work should be a contribution in its own right

Structure

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Conclusions and further work

- Be brief.
- Several sentences to summarize your idea and contributions/findings.

Summary

If you remember nothing else:

- **Identify your key idea**
- **Make your contributions explicit**
- **Use examples**
- **Claim then evidence**

Appendix 1:
The process of writing

The process

- Start early. Very early.
  - Hastily-written papers get rejected.
  - Papers are like wine: they need time to mature
- Collaborate
- Use CVS (SVN) to support collaboration

Getting help

Get your paper read by as many friendly guinea pigs as possible

- Experts are good
- Non-experts are also very good
- Each reader can only read your paper for the first time once! So use them carefully
- Explain carefully what you want ("I got lost here" is much more important than "Jarva is mis-spelt".)

Getting expert help

- A good plan: when you think you are done, send the draft to the competition saying “could you help me ensure that I describe your work fairly?”.
- Often they will respond with helpful critique (they are interested in the area)
- They are likely to be your referees anyway, so getting their comments or criticism up front is Jolly Good.

Listening to your reviewers

Treat every review like gold dust

Be (truly) grateful for criticism as well as praise

This is really, really, really hard

But it's
really, really, really, really, really, really, really, really, really, really
important

Listening to your reviewers

- Read every criticism as a positive suggestion for something you could explain more clearly
- DO NOT respond “you stupid person, I meant X”. Fix the paper so that X is apparent even to the stupidest reader.
- Thank them warmly. They have given up their time for you.

Appendix 2:
Language and style

Basic stuff

- Submit by the deadline
- Keep to the length restrictions
  - Do not narrow the margins
  - Do not **use 6pt font**
  - On occasion, supply supporting evidence (e.g. experimental data, or a written-out proof) in an appendix
- Always use a spell checker

Visual structure

- Give strong visual structure to your paper using
  - sections and sub-sections
  - bullets
  - italics
  - laid-out code
- Find out how to draw pictures, and use them

Visual structure

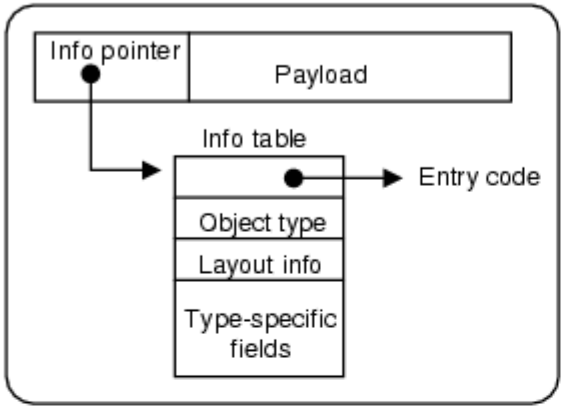

Figure 3. A heap object

The three cases above do not exhaust the possible forms of f. It might also be a *THUNK*, but we have already dealt with that case (rule THUNK). It might be a *CON*, in which case there cannot be any pending arguments on the stack, and rules UPDATE or RET apply.

4.3 The eval/apply model

The last block of Figure 2 shows how the eval/apply model deals with function application. The first three rules all deal with the case of a *FUN* applied to some arguments:

- If there are exactly the right number of arguments, we behave exactly like rule KNOWNCALL, by tail-calling the function. Rule EXACT is still necessary — and indeed has a direct counterpart in the implementation — because the function might not be statically known.
- If there are too many arguments, rule CALLK pushes a *call*

remainder of the object is called the *payload*, and may consist of a mixture of pointers and non-pointers. For example, the object $CON(C\ a_1 \ldots a_n)$ would be represented by an object whose info pointer represented the constructor C and whose payload is the arguments $a_1 \ldots a_n$.

The info table contains:

- Executable code for the object. For example, a *FUN* object has code for the function body.
- An object-type field, which distinguishes the various kinds of objects (*FUN*, *PAP*, *CON* etc) from each other.
- Layout information for garbage collection purposes, which describes the size and layout of the payload. By "layout" we mean which fields contain pointers and which contain non-pointers, information that is essential for accurate garbage collection.
- Type-specific information, which varies depending on the object type. For example, a *FUN* object contains its arity; a *CON* object contains its constructor tag, a small integer that distinguishes the different constructors of a data type; and so on.

In the case of a PAP, the size of the object is not fixed by its info table; instead, its size is stored in the object itself. The layout of its fields (e.g. which are pointers) is described by the (initial segment of) an argument-descriptor field in the info table of the FUN object which is always the first field of a PAP. The other kinds of heap object all have a size that is statically fixed by their info table.

A very common operation is to jump to the entry code for the object, so GHC uses a slightly-optimised version of the representation in Figure 3. GHC places the info table at the addresses *immediately*

The Body of a Section [Stone]

- What happens here
- How this fits (optional)
- The results
- Transition

In this section …

This section continues the derivation by …

Thus far, the discussion has … Here, …

Use the active voice

The passive voice is “respectable” but it DEADENS your paper.
Avoid it at all costs.

NO	YES
It can be seen that...	We can see that...
34 tests were run	We ran 34 tests
These properties were thought desirable	We wanted to retain these properties
It might be thought that this would be a type error	You might think this would be a type error

“We” = you and the reader

“We” = the authors

“You” = the reader

Use simple, direct language

NO	YES
The object under study was displaced horizontally	The ball moved sideways
On an annual basis	Yearly
Endeavour to ascertain	Find out
It could be considered that the speed of storage reclamation left something to be desired	The garbage collector was really slow

References

- References are annotations, not nouns
  - Sentence should still make sense if you remove the references

- *Castelli and Brown [3] showed that …*
  - Not *[3] showed that …*
- *Some prior systems are unsound [3,4].*
  - Not *The systems presented in [3,4] are unsound.*