HOW TO WRITE PAPERS
SO PEOPLE CAN READ THEM

Derek Dreyer
MPI for Software Systems

PLMW@POPL 2016
St. Petersburg, Florida
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
All work and no play makes Jack a dull boy.
Have you read any PL papers lately?
Have you read any PL papers lately?
Have you read any PL papers lately?

- You may think you just lack the technical sophistication to understand them.
Have you read any PL papers lately?

- You may think you just lack the technical sophistication to understand them.

- But in fact, many papers are poorly written.
So if you can write clear, accessible papers...

- People will **enjoy** reading them!
- People will **learn** something from them!
- They will get **accepted** to POPL!
A piece of research
By downcasting the pre-axial gaskets, we achieved 47% reduction in XPS latency on the re-uptake bivalve!
By downcasting the pre-axial gaskets, we achieved 47% reduction in XPS latency on the re-uptake bivalve!

OK, but what does it **do**, and why do I **care**?
The good news

- There are **principles** you can follow that will help you write clearer, more readable prose
  - Based on how readers process information
The good news

- There are **principles** you can follow that will help you write clearer, more readable prose
  - Based on how readers process information
The good news

- There are **principles** you can follow that will help you write clearer, more readable prose
  - Based on how readers process information

  - “Be clear”
  - “Omit needless words”
  - …
The good news

- There are **principles** you can follow that will help you write clearer, more readable prose
  - Based on how readers process information
  - “Be clear”
  - “Omit needless words”
The good news

- There are principles you can follow that will help you write clearer, more readable prose
  - Based on how readers process information

- These principles are constructive:
  - Easy to check if your text satisfies these principles
  - If not, principles suggest improvements
Inspirations for this talk

- **Joseph M. Williams.** *Style: Toward clarity and grace.* 1990. (book)

- **Norman Ramsey.** *Learn technical writing in two hours per week.* (course notes)

- **Simon Peyton Jones.** *How to write a great research paper.* (talk)
Inspirations for this talk

- **Joseph M. Williams.** *Style: Toward clarity and grace.* 1990. (book)

  Talk developed jointly with
  **Rose Hoberman**
  @ MPI-SWS

- **Simon Peyton Jones.** *How to write a great research paper.* (talk)

Sentences & paragraphs
Flow

It should be clear how each sentence and paragraph relates to the adjacent ones
Does this text flow?
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Does this text flow?

Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach.
Old to new

- Begin sentences with old info
  - Creates link to earlier text

- End sentences with new info
  - Creates link to the text that follows
  - Also places new info in position of emphasis
Applying old-to-new

Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. The game-playing technique, originally proposed by Jones et al., follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games. This is a general design principle for cryptographic proofs to ease their management.
Applying old-to-new

Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. To make it easier to manage such proofs, Jones et al. have proposed a new design principle, called the game-playing technique. This technique follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games.
Security proofs of cryptographic protocols are crucial for the security of everyday electronic communication. However, these proofs tend to be complex and difficult to get right. To make it easier to manage such proofs, Jones et al. have proposed a new design principle, called the game-playing technique. This technique follows a code-based approach where the security properties are formulated in terms of probabilistic programs, called games.
But flow is not enough!
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
What about this text?

Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. However, many are currently facing extinction. A smaller species that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are not naturally social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
Coherence

It should be clear how each sentence and paragraph relates to the big picture.
One paragraph, one point

- A paragraph should have one main point, expressed in a single point sentence

- Typically the point sentence should appear at or near the beginning of the paragraph
Lions and tigers are some of the most dramatic and awe-inspiring species of cats. Most of these large cats, however, are currently facing extinction. A smaller cat that has been more evolutionarily successful is the house cat. Although house cats are currently the most popular pet in the world, they are in many ways anti-social. It would therefore be interesting to study whether house cats can be trained to be more sociable.
There appears to be a negative correlation between the charisma of a species and its ability to survive. Lions and tigers, for instance, are among the most majestic creatures in the animal kingdom, yet they are currently facing extinction. In contrast, the house cat is evolutionarily quite successful, even though it is mostly known for stupid pet tricks.
Flow & coherence

Create flow with old to new

Create coherence with one paragraph, one point
Two other principles

- **Name your baby:**
  - Give unique names to things and use them consistently

- **Just in time:**
  - Give information precisely when it is needed, not before
Structure of a research paper
A structure that works

- **Abstract** (1-2 paragraphs, 1000 readers)
- **Intro** (1-2 pages, 100 readers)
- **Main ideas** (2-3 pages, 50 readers)
- **Technical meat** (4-6 pages, 5 readers)
- **Related work** (1-2 pages, 100 readers)
A structure that works

- **Abstract** (1-2 paragraphs, 1000 readers)
- **Intro** (1-2 pages, 100 readers)
- **Main ideas** (2-3 pages, 50 readers)
- **Technical meat** (4-6 pages, 5 readers)
- **Related work** (1-2 pages, 100 readers)
The CGI model for an abstract/intro

- **Context:**
  - Set the stage, motivate the general topic

- **Gap:**
  - Explain your specific problem and why existing work does not adequately solve it

- **Innovation:**
  - State what you’ve done that is new, and explain how it helps fill the gap
An abstract for this talk
Context

Learning to write well is an essential part of becoming a successful researcher.
Gap

Learning to write well is an essential part of becoming a successful researcher. Unfortunately, many researchers find it very hard to write well because they do not know how to view their text from the perspective of the reader.
Learning to write well is an essential part of becoming a successful researcher. Unfortunately, many researchers find it very hard to write well because they do not know how to view their text from the perspective of the reader. In this talk, we present a simple set of principles for good writing, based on an understanding of how readers process information. Unlike such platitudes as "Be clear" or "Omit needless words", our principles are constructive: one can easily check whether a piece of text satisfies them, and if it does not, the principles suggest concrete ways to improve it.
Introduction

• Like an expanded version of the abstract

• Alternative approach (SPJ): Eliminate Context

  – Start with a concrete example, e.g. “Consider this Haskell code…”
  – If this works, it can be effective, but I find it often doesn’t work
  – It assumes reader already knows context
A structure that works

- Abstract (1-2 paragraphs, 1000 readers)
- Intro (1-2 pages, 100 readers)
- **Main ideas** (2-3 pages, 50 readers)
- Technical meat (4-6 pages, 5 readers)
- Related work (1-2 pages, 100 readers)
“Main ideas” section

- Use **concrete illustrative examples** and high-level intuition

- Do **not** have to show the general solution (that’s what the technical section is for)
Why have a “main ideas” section at all?

1. Forces you to have a “takeaway”
2. Many readers only care about the takeaway, not the technical details
3. For those who want the technical details, the main ideas are still useful as “scaffolding”
A structure that works

- Abstract (1-2 paragraphs, 1000 readers)
- Intro (1-2 pages, 100 readers)
- Main ideas (2-3 pages, 50 readers)
- Technical meat (4-6 pages, 5 readers)
- Related work (1-2 pages, 100 readers)
Related work

1. **It goes at the end** of the paper.
   - You can only properly compare to related work once you’ve explained your own.

2. **Give real comparisons**, not a “laundry list”!
   - Explain in detail how your work fills the **Gap** in a way that related work doesn’t.
Summary of principles

- Old to new
- One paragraph, one point
- Name your baby
- Just in time
- CGI model for abstract/intro
- Have a “main ideas” section
- Compare with related work at the end