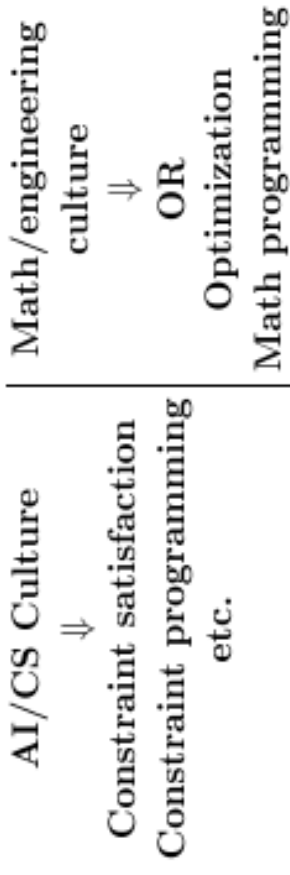


Past and Future of CP

John Hooker
October 2005

One of my
slides from
CP96
panel
discussion on
future of CP



- Separate development is probably a good thing for awhile.
- But the time is right for synthesis.
- This seems to be widely recognized now.
- It will happen quickly.
- It may be helpful to become consciously aware of differences between the two approaches ...

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AI/CS Culture ↓ Constraint satisfaction Constraint programming etc.	Math/engineering culture ↓ OR Optimization Math programming
<ul style="list-style-type: none">• Separate development is probably a good thing for awhile.• But the time is right for synthesis.• This seems to be widely recognized now.• It will happen quickly.• It may be helpful to become consciously aware of differences between the two approaches ...	

Prediction

- But the time is right for synthesis.
- This seems to be widely recognized now.
- It will happen quickly.

Did it happen?

- First CPAIOR workshop was in 1999.
 - Became a conference with proceedings in 2004.
- Hybrid methods often used in CP.
 - Growing literature.
- There are CP sessions in OR, math programming meetings.
 - But OR has been slow to recognize CP.

Future of OR/CP integration?

- Depends partly on what the commercial solvers do.
 - Eclipse – unknown in OR world
 - OPL Studio – only a first step.
 - BARON – already combines OR/CP for global optimization
- New CP systems routinely include hybridization.
 - People will use something that works.
- OR solvers are slow to incorporate hybridization.
 - Highly engineered solvers allow the community to postpone looking at other approaches.
 - OR modeling style does not easily accommodate CP.



Related Issue

- Why so little CP in North America?
 - Lags behind Europe, East Asia.
- Some factors:
 - Historical inertia.
 - CP started in Europe, where few North Americans are trained.
 - OR is well established, particularly in USA.
 - CP often seen as competition. There is no obvious opening for it.

Future of CP in North America?



- Assuming CP continues to prosper, it may catch on with the next generation...
 - ...which will have less vested interest in current OR methods.
- Best point of entry may be through integrated CP/OR methods.

Another slide
from CP96
panel
discussion

Next big research thrust: Modeling

- Perhaps there can be no science of modeling, because science is modeling.
- But we can develop modeling tools and understand them.
- This is essential for widespread use of CP.
- A strength of CP (relative to OR) is its larger repertoire of modeling constructs, plus its familiarity with formal languages.
- Models serve two purposes:
 1. Understanding: they reduce the problem to intelligible form.
 2. Solution: they permit automatic deduction of consequences.
- We have focused on number 2.
- We need better modeling tools and packages for number 1, along with methods for converting models to soluble form.
- Part of number 1 is developing tools to explain the solution of a model.

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We have this:

and are beginning to see this:

- Part of number 1 is developing tools to explain the solution of a model.

What next?

- CP has become an established field.
 - Now we have an association (ACP).
- Sociology of organizations will play a role...

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- Academic fields.
 - For example, computer science, molecular biology.
 - Dedicated to answering a core question.
 - Practice is important...
 - ... but application papers may appear at the back of the conference proceedings volume.

Case study: Operations research.

- Originally conceived as an engineering field, but it wants to be an academic field.
- Partly because it includes mathematical programming and other areas of mathematics.
- Yet it is unclear what the core question is.
- So OR has no natural home in the academy.
 - Sometimes engineering, sometimes business school, sometimes mathematical sciences.
 - Often a 2nd class citizen.

- Past reports of OR's death have been greatly exaggerated....
 - ...but there is something behind these reports.
 - Relatively few PhDs, academic jobs in OR.
 - No longer taught in business school (a few exceptions).
- High-grade commercial software keeps OR practice alive.
 - The tools are very useful, after all.

The problem with OR

- It wants to be an academic field, but it is **defined by its techniques** rather than a core question.
- This could happen to CP.

How about CP?

- CP should decide what it wants to be.
 - An engineering field?
 - I don't think so.
 - An academic field with applications?
 - Yes, but it seems to be defined by its techniques, not by a core question.
- A mature field can remain exciting when it pursues a mystery.
 - CP must do this.