

Designing and Presenting a Scientific Poster

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Poster Sessions at Major Conferences

- Sessions for attendees to mingle in an around posters and presenters
- Posters usually viewable any time the conference is in session
- Often there is a poster session or reception
- Often 100s of posters are presented



Presentations vs. Papers

Papers

- Single preplanned narrative
- Write/Read
- Remote audience
- Reader can take their time
- Multiple pages
- Arms-length interaction

Presentations

- Preplanned narrative
- Speak/Listen
- Captive audience
- Time-slot of 15-60 minutes
- Multiple slides
- Increased chance of interaction

Presentations vs. Papers vs. Posters

Papers

- Single preplanned narrative
- Write/Read
- Remote audience
- Reader can take their time
- Multiple pages
- Limited interaction

Presentations

- Preplanned narrative
- Speak/Listen
- Captive audience
- 15-60 minutes
- Multiple slides
- Increased chance of interaction

Posters

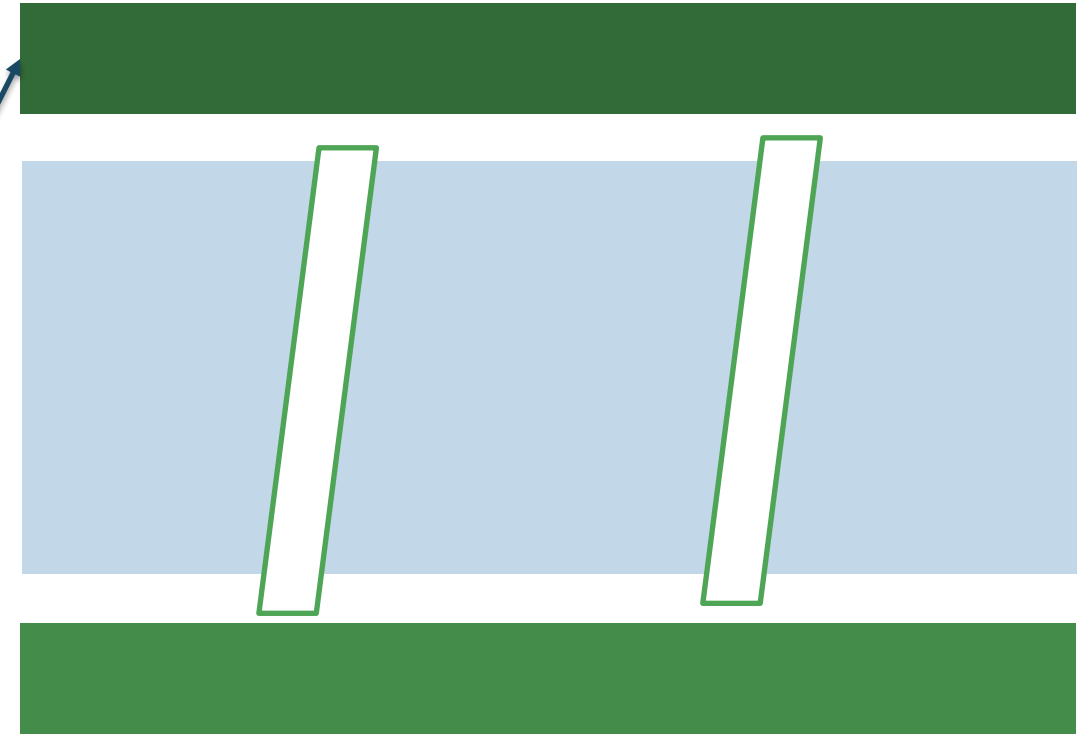
- Multiple narratives
- Discussion
- Browsing audience
- ~5 minutes per discussion
- Single page/slide
- Interactive
- *Often posters can be viewed outside of session*

Understanding Your Your Audience

- People in your field of specialization
 - Can get to specifics
- People in closely-related field of specialization
 - Need context, may be unfamiliar with your jargon
- People in unrelated fields
 - Need to explain the problem and the solution. Will not understand your jargon

Basic Poster Content – Header

- Title
 - Briefly convey the subject matter, orient the viewer
 - Attract interest without gimmicks
- Author(s)
 - Contact Information



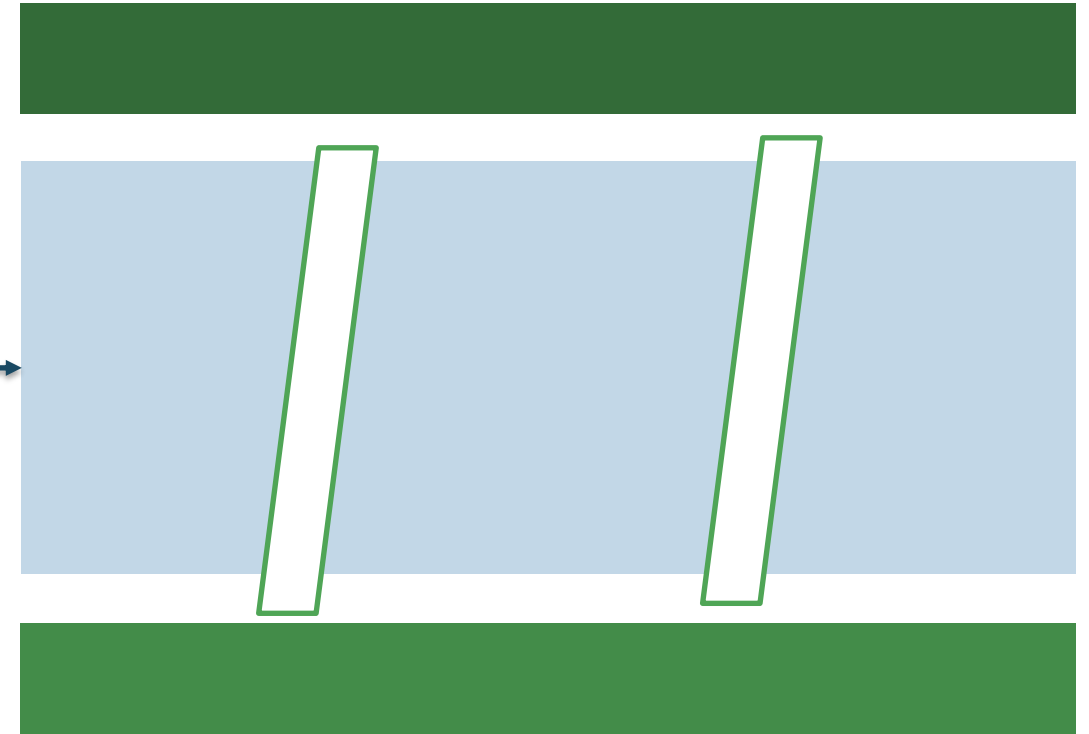
Basic Poster Content – Main Section Alternate #1

- Introduction
 - Problem Statement (why it matters), avoiding as much jargon as possible
- Methodology
 - Not too much detail, graphics work well in many cases
- Results
 - What worked, what didn't
 - Brief data analysis
- Conclusions
 - Your interpretations (Don't repeat results)
 - Further work
- Extras
 - QR Code: Pointer to online resources
 - Flip or slide panels
 - Video



Basic Poster Content – Main Section Alternate #2

- Introduction
 - Problem Statement (why it matters), avoiding as much jargon as possible
- System Design & Features
 - Not too much detail, graphics work well in many cases
- Future Enhancements
 - Further work
- Extras
 - QR Code: Pointer to online resources
 - Flip or slide panels
 - Video



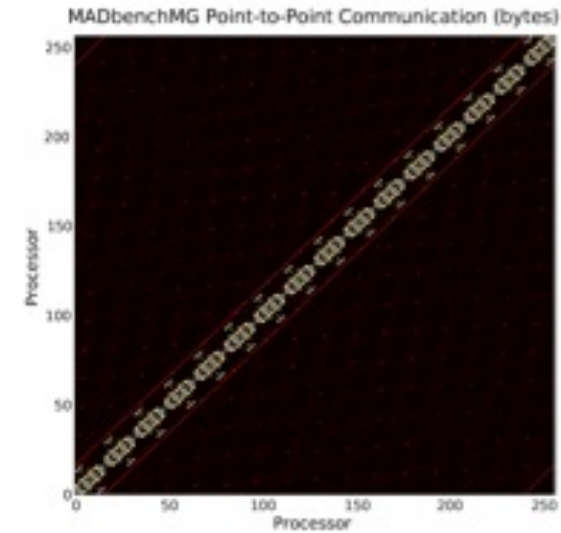
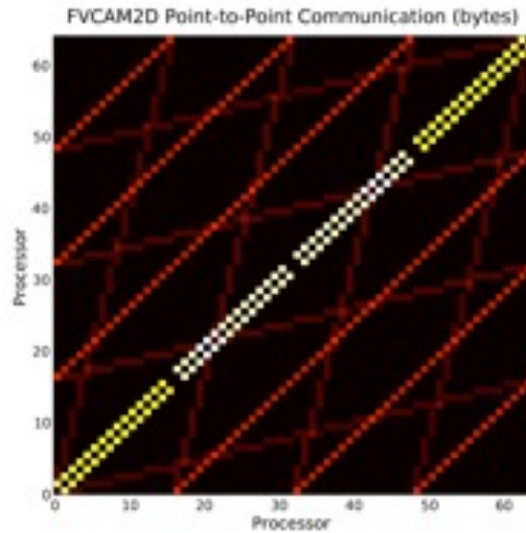
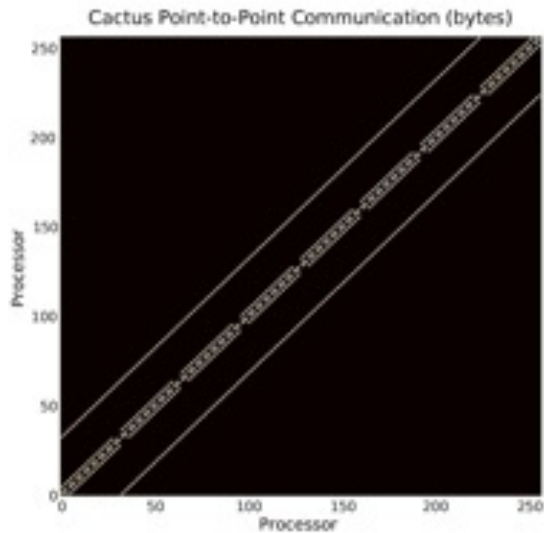
Basic Poster Content – Footer

- Citations
- Acknowledgements/ Logos / Institutional Verbiage
- Further Information



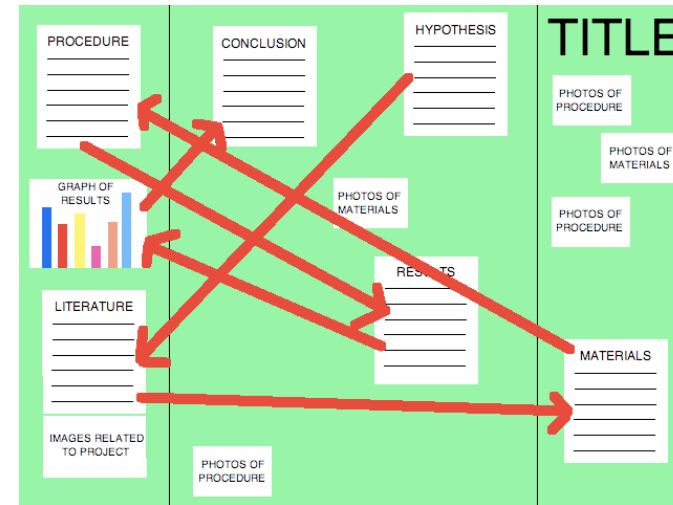
Use Visual Communication

- Graphics to help you talk to your work
- Label graphs and charts legibly, and clearly enough that the label stands on its own
- Use different portions of poster to engage at different level of abstraction and separate logical concepts



Things to Avoid (1)

- **Over-crowded or busy layouts**
 - Flow is often confusing, or the eye doesn't know where to look
- **Garish color schemes or awkward font choices**
- **Dark backgrounds - can print poorly**



Credit: Applied Math Dept., Illinois Tech



<http://bonfx.com/bad-typography/>

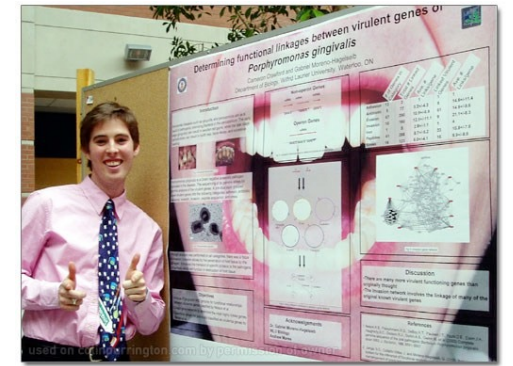
Things to Avoid (3)

Don't Be a Winner at Bad Poster Bingo by Zen Faulkes
<http://betterposters.blogspot.com/2013/10/bad-poster-bingo.html>

Different parts of poster don't line up		Zigzag reading order	More than three typefaces	Long-winded title
Gradient fills in coloured boxes	Big blocks of text	Photographic background	Unlabelled error bars on graphs	Pixelated pictures
More than five colours	Institutional logos bookending title	Free space	ALL CAPITALS	Text with shadows, outlines, or bevels
Abstract	<u>Underlined text</u>	Comic Sans	3-D graphs	Checking tablet or phone during presentation
Tables showing data that could be in a graph	Poster does not fit on poster board	Comic Sans (it's that annoying)	Objects almost touching or overlapping	<small>Tiny, unreadable type</small>

Marketing Your Poster

- Make your poster compelling so it will stand out
- Look like you want people to stop and talk
- Don't stand in front of your poster
- Make room for multiple visitors
- Talk to your visitors as opposed to your poster
- Think of various short pitches that you could employ
- Handouts, business cards



Pink Guy with Pink Poster. Nicole Barker.

Can be taken to excess:

Keegan, D.A., and S.L. Bannister. Effect of color coordination of attire with poster presentation on poster popularity. *Canadian Medical Association Journal* 169:1291-1292 (2003)

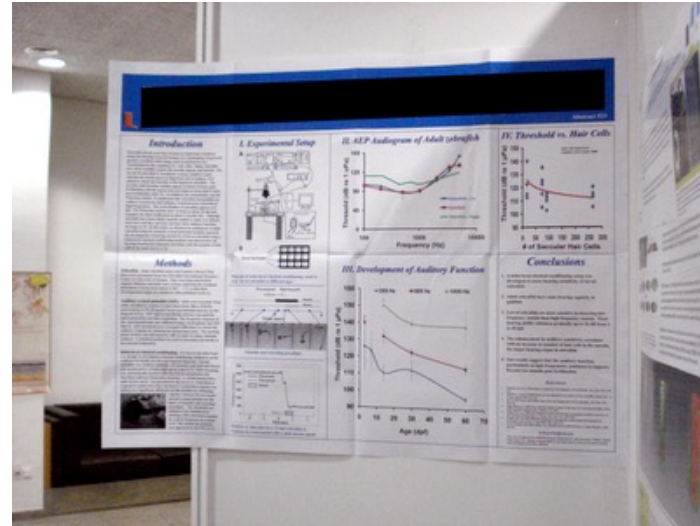
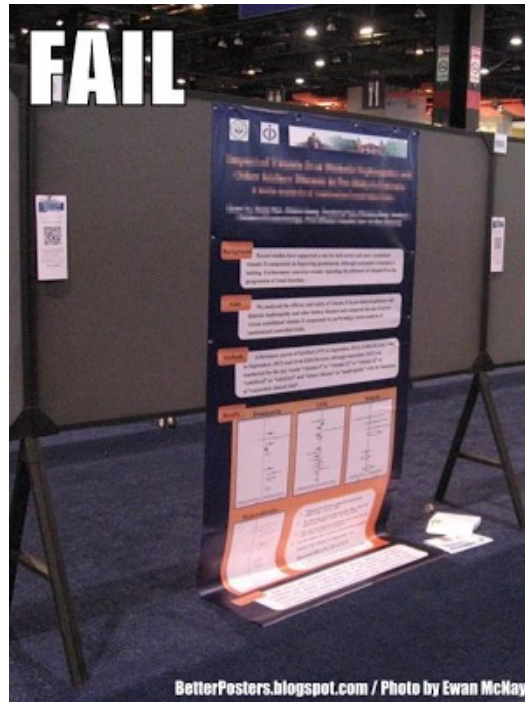
<http://betterposters.blogspot.com/2012/03/colour-clash.html>

1-Minute Pitch and/or Video Introduction

- Many poster programs feature a set of 1-minute pitches where all poster authors can explain why someone should visit their poster
 - You need a hook to stand out
 - Pose a puzzle
- Recent virtual poster sessions often have online posters accompanied with short introduction videos by authors
 - Record one of your pitches and use a visual on the poster

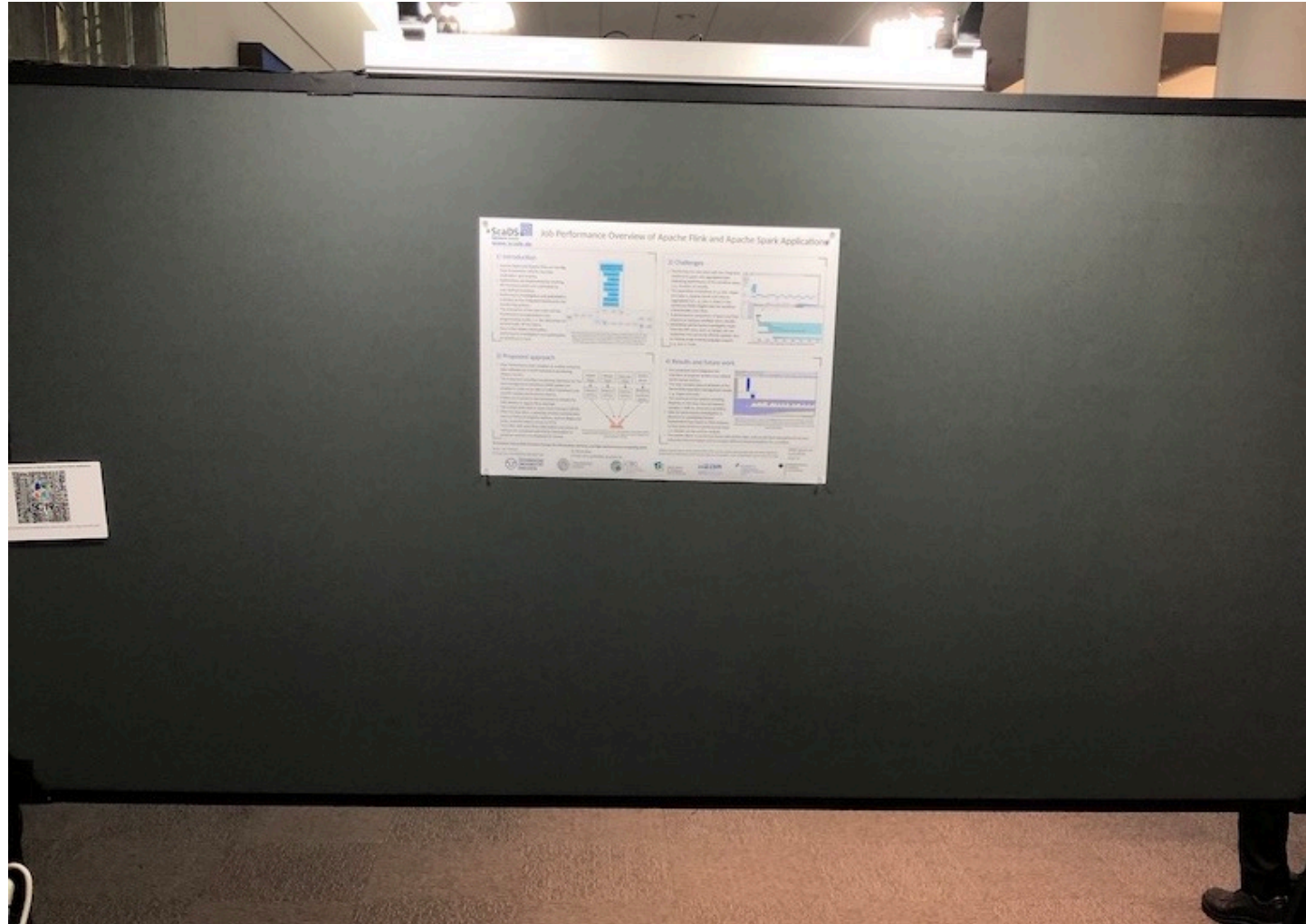
Follow Poster Session Instructions

- Note format and size requirements

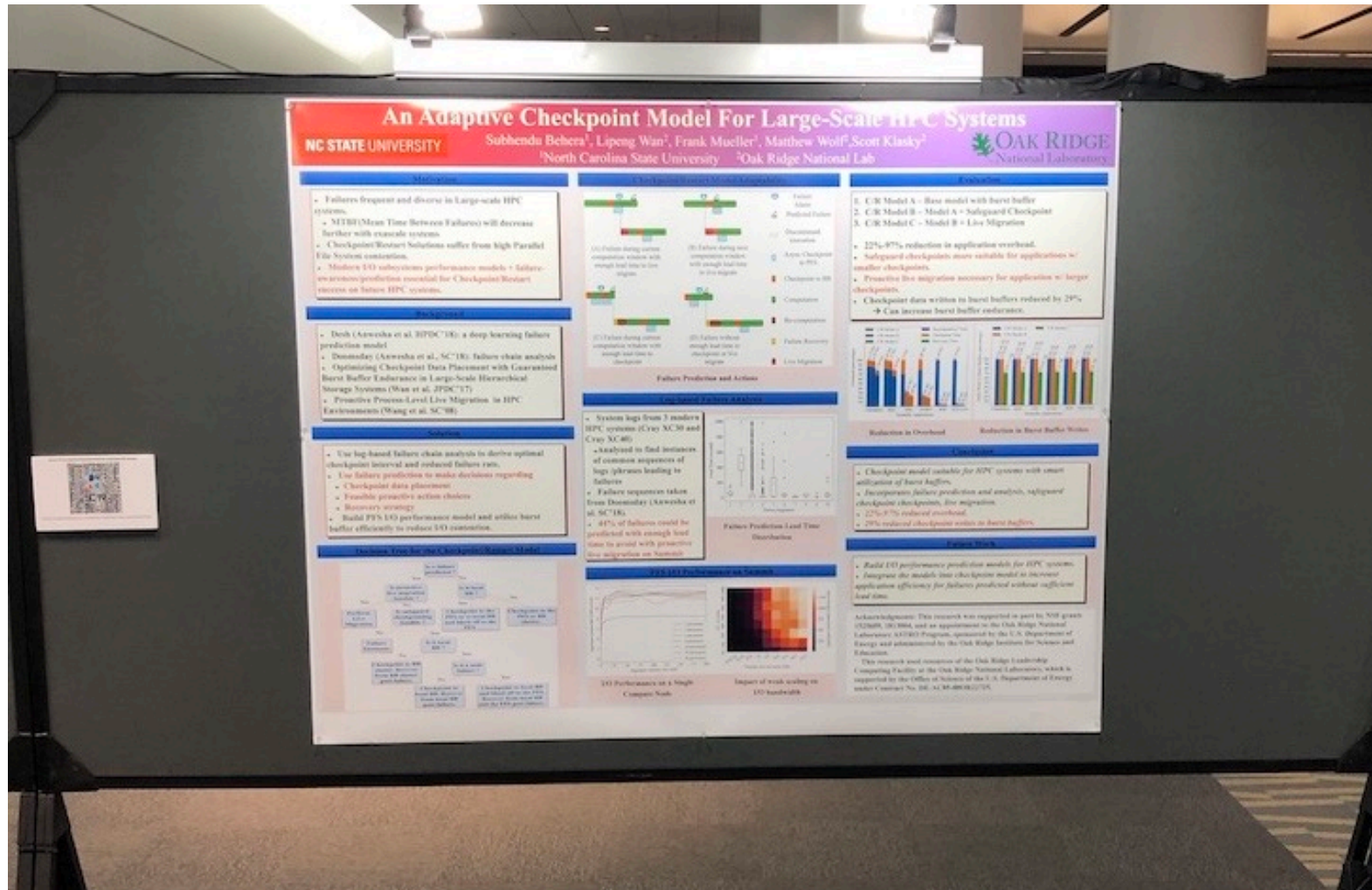


- Put up and take down your poster in a timely manner

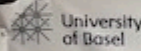
Standing Out - Posters from SC19



Standing Out - Posters from SC19




Standing Out - Posters from SC19



University of Basel

A Runtime Approach for Dynamic Load Balancing of OpenMP Parallel Loops in LLVM



ETH ZÜRICH
SWISS NATIONAL SCIENCE FOUNDATION

1. RESEARCH PROBLEM

- Load imbalance is the major source of performance loss in computationally-intensive applications.
- Efficient scheduling of parallel loops can improve the performance of such programs.
- The current OpenMP specification only provides three choices for loop scheduling which do not support a wide research space with great potential for performance improvement.
- This work augments the LLVM OpenMP runtime library (RTL) with eleven state-of-the-art plus three improved and ready-to-use scheduling techniques.

OpenMP 5.0

- Scheduling techniques available in the current OpenMP standard: static, guided, random, and dynamic (DQ).
- Current application system scenarios require more sophisticated scheduling techniques yielding unexploited performance improvements.

Why LLVM?

- The LLVM OpenMP runtime (LLVM-RTL) is open source and widely used in many production and scientific codes.
- The LLVM OpenMP runtime library, libomp, is highly compatible with other OpenMP implementations, such as Intel and GCC.

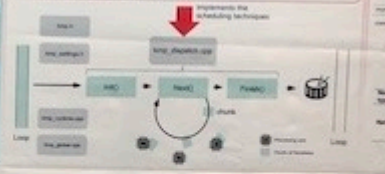
Scheduling Techniques Added to the LLVM OpenMP Runtime Library

- Fixed Size Chunking (fsc), 1985
- Partitioning (p), 1982
- Partitioning 2 (p2), 1986
- Tagged (tag), 1982
- Adaptive Partitioning (ap), 1990
- SOLO (solo), 1987
- Adaptive Integrated Partitioning and variants (aid, ai, ai2, ai3, ai4, ai5, and ai6), 1999-2000
- Adaptive Partitioning (ap), 2000
- Improvements to the fsc, p, p2, and ai techniques are detailed by the suffix "im" in 2019.

2. OPENMP LOOP SCHEDULING IN LLVM

First Method for the Implementation of Additional Scheduling Techniques

- libomp uses three main functions to perform the scheduling of iterations from a loop into threads: `init()`, `work()`, and `finalize()`.
- The added loop scheduling techniques are located in the `loop_scheduler.cpp` file.
- The remaining five initial state required environment variables and make the OpenMP runtime system aware of the above newly introduced techniques.



3. DESIGN OF EXPERIMENTS

Details about the benchmarks and the method.

Overview of loop scheduling techniques

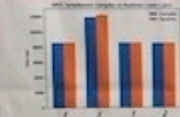
Technique	Category	Implementation
Fixed Size Chunking (fsc)	Static	libomp
Partitioning (p)	Static	libomp
Partitioning 2 (p2)	Static	libomp
Tagged (tag)	Static	libomp
Adaptive Partitioning (ap)	Dynamic	libomp
SOLO (solo)	Dynamic	libomp
Adaptive Integrated Partitioning (aid)	Dynamic	libomp
Adaptive Integrated Partitioning variants (ai)	Dynamic	libomp

Thread-to-core mapping strategies

Strategy	Mapping
Static	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
Dynamic	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

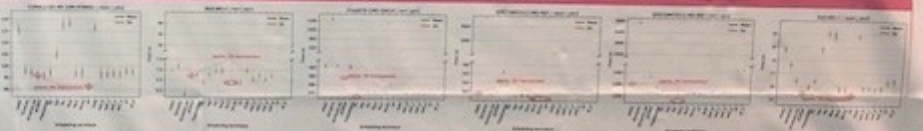
4. OVERHEADS OF THE RUNTIME DLB APPROACH

The runtime does not induce significant overhead.



5. PERFORMANCE EXPERIMENTS

Parallel execution time of the 3 standard, 3 non-standard, and 11 plus the 3 sophisticated added scheduling strategies on various benchmarks executed on two multicore systems. Each experiment was repeated 20 times. Green bars denote the mean, while orange bars denote the standard deviation of the parallel execution time for all experiments. Red lines denote benchmark suite, application, input size, system partition, joining strategy.



6. CONCLUSION

Performance gains beyond OpenMP standard

- OpenMP applications can reap beyond the performance achieved by the standard scheduling choices.
- We provide a comparison between the standard scheduling techniques versus the eleven state-of-the-art plus three improved scheduling techniques.
- The performance gains observed on the degree of load imbalance during the application execution on a multicore system.

Insignificant overhead

- Frequent calls to the OpenMP runtime library that induce overhead that can impact the end-user benefits of dynamic scheduling. The overhead impacts "static", "dynamic", "guided", and "auto" scheduling for static and guided (SOLO) and 3.8 times more only for dynamic (DQ).

Fastest performer

- The standard scheduling technique, dynamic (D), or SOLO, offers great performance. The performance degradation is due to the high overhead caused by frequent calls to the scheduling function and lack of SOLO to fully utilize the multicore.
- Further profile means accurately are needed for a precise cycle time setup for a particular application system pair.

Consistent outperformer

- SOLO is the most consistent and outperforming scheduling technique among the following variants.
- SOLO does not require profiling information.

Information vs. performance trade-off

- Techniques such as fsc, p, p2, tag, and solo require minimal application profiling information.
- Performance degrades with and when the joining time is too long.
- SOLO and the variants (aid, ai) require more application profiling data.
- The profiling process is time-consuming since it must be done prior to the application execution for a particular input on the particular system.

7. Future Work

User-Defined Scheduling Invariant

- We will develop an interface that allows the user to define custom scheduling invariants for the application.

Extension to LLVM

- We will extend our implementation into the LLVM OpenMP runtime library.

ACKNOWLEDGMENT

This work is part supported by the Swiss National Science Foundation (SNSF) through the project "Dynamic Load Balancing of OpenMP Parallel Loops in LLVM" (SNF-131590-1). We thank the reviewers for their constructive comments.

REFERENCES

[1] J. H. Kukula, S. H. Kim, and S. H. Kim, "A Runtime Approach for Dynamic Load Balancing of OpenMP Parallel Loops in LLVM," in *Proceedings of the 2019 ACM SIGPLAN Conference on Programming Language Design and Implementation*, 2019, pp. 100-112.

[2] J. H. Kukula, S. H. Kim, and S. H. Kim, "A Runtime Approach for Dynamic Load Balancing of OpenMP Parallel Loops in LLVM," in *Proceedings of the 2019 ACM SIGPLAN Conference on Programming Language Design and Implementation*, 2019, pp. 100-112.

[3] J. H. Kukula, S. H. Kim, and S. H. Kim, "A Runtime Approach for Dynamic Load Balancing of OpenMP Parallel Loops in LLVM," in *Proceedings of the 2019 ACM SIGPLAN Conference on Programming Language Design and Implementation*, 2019, pp. 100-112.

Standing Out - Posters from SC19

ARGONNE LEADERSHIP COMPUTING FACILITY

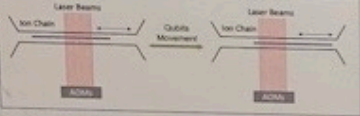
ILP-Based Scheduling for Linear-Tape Model Trapped-Ion Quantum Computers

Xin-Chuan Wu¹, Yongshan Ding¹, Yunrong Shi¹, Yan Alexeev², Hal Finkel¹, Kilisek Kim¹, Frederic T. Chong¹
¹University of Chicago (USA), ²Argonne National Laboratory (USA)

Abstract
 Quantum computing (QC) is a potential post-Moore HPC technology. QC algorithms aim to solve problems beyond the capabilities of even the largest classical supercomputers. Linear-tape model trapped-ion is one of the leading technologies for building scalable quantum computers. We present our ILP-based scheduling algorithm for linear-tape model machine, called STRIQC, a Scheduler for Trapped-Ion Quantum Computing. Our results show that STRIQC can reduce 29.47% circuit latency on average comparing to FIFO scheduling. The results also suggest we will achieve the optimization for large circuits with classical HPC support.

Linear-Tape Model

- Acousto-optic modulators (AOMs) generate the laser beams to perform single-qubit rotation gates and XX-gates between arbitrary pairs of qubits.
- Trapped ion quantum computers provide all-to-all connectivity if all qubits are within the laser beam interaction zone.
- Ion movement: Changing voltages can move the center of the trap. Qubit state remain undisturbed through shuttling.
- The whole ion chain moves together, like a linear tape.
- The movement time is proportional to the moving distance.



Optimization

Laser Beam: 4

Total moving distance: 6
Circuit depth: 3

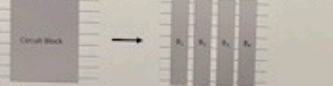
Total moving distance: 4
Circuit depth: 4

Total moving distance: 4
Circuit depth: 3

Execution Time = Depth × Gate Time + Shuttling Distance × Shuttling Time

Optimization V.S Compilation Time

- Optimizing the whole circuit might take long time to finish the compilation.
- The circuit can be approximately optimized by dividing it into multiple small circuit blocks.
- Performing STRIQC on each circuit block to get the approximate optimization for the entire circuit.



Compilation Flow


- High-Level Quantum Program
- Quantum Assembly (QAASM)
- Swap Gate Insertion
- Trapped Ion Native Gates
- Grouping Circuit Blocks
- STRIQC (ILP Solver)
- Scheduled Gates and Movements

ILP-Based Scheduling

Results — (Laser Beams: 16, Time_{gate} = 100ns, Time_{move} = 5us)

Total Qubit: 32

Total Qubit: 64



Conclusion

- STRIQC is the first scheduling algorithm optimized for linear-tape model trapped ion quantum computers.
- STRIQC generates the optimal sequence of ion movement operators and quantum gates in terms of latency.

Future Work

- Investigate factors that cause long compilation time, and explore techniques to reduce the compilation time.
- Evaluate the total circuit fidelity with detail noise models, and schedule circuits to maximize success rate.
- Implement our tool flow on HPC to achieve large circuit block optimization to increase the quality of the solution.

Acknowledgments

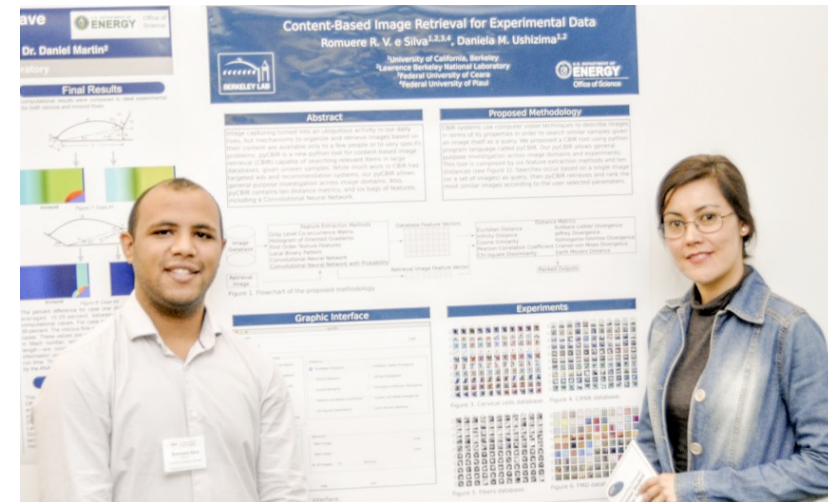
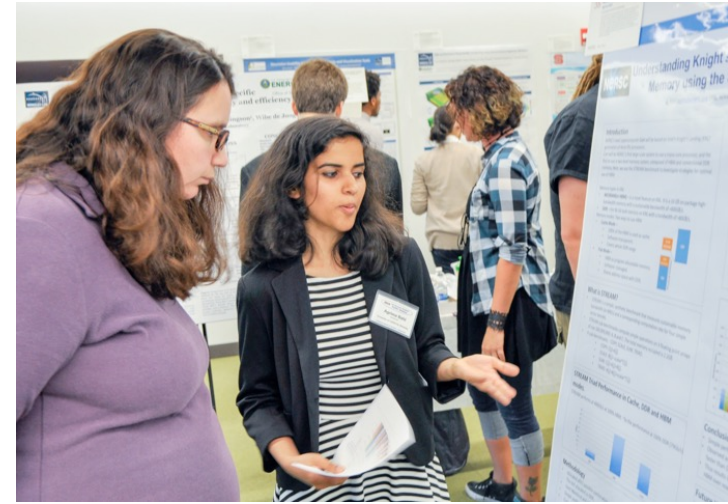
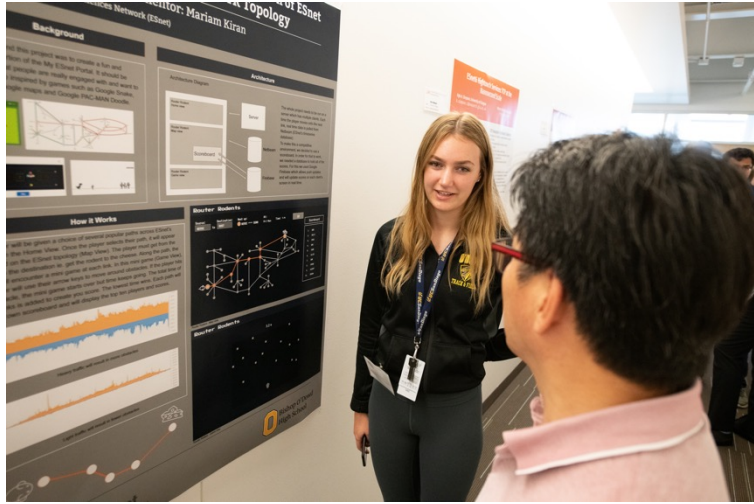
This research used resources of the Argonne Leadership Computing Facility, which is a DOE Office of Science User Facility supported under Contract DE-AC02-07OR21400. This research was supported by the Executive Computing Project (ECP), Project Number: 17-0C-00-SC, a collaborative effort of two DOE organizations - the Office of Science and the National Nuclear Security Administration, responsible for the planning and operation of a capable executive computing ecosystem, including software, applications, hardware, advanced system engineering and early method development, to support the nation's executive computing mission. The material was supported by the U.S. Department of Energy, Office of Science, and supported by the National Science Foundation under Grant No. 1810212. This work is funded in part by EPOCC, an NSF Expedition in Computing, under grant ICF-170649. This work is also funded in part by NSF Award 1809204.

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Resources

- Colin Purrington, Swarthmore College
 - <http://colinpurrington.com/tips/poster-design>
 - Suggestions for software, templates, and more...
- Zen Faulkes, University of Texas
 - <http://betterposters.blogspot.com>
 - Advice and poster critiques, up-to-date resource,...
- George Hess, Kathryn Tosney, and Leon Liegel, North Carolina State University
 - <http://go.ncsu.edu/posters>
 - More basic advice on formats, style, poster elements, etc.

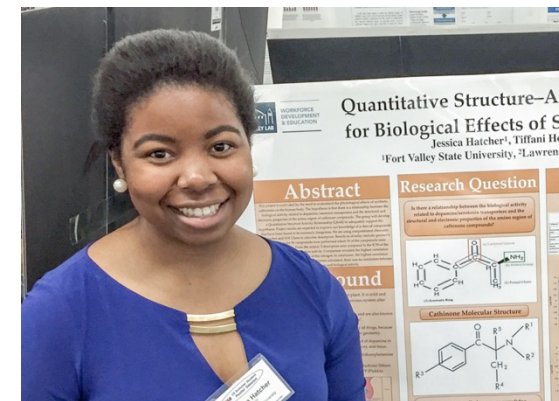
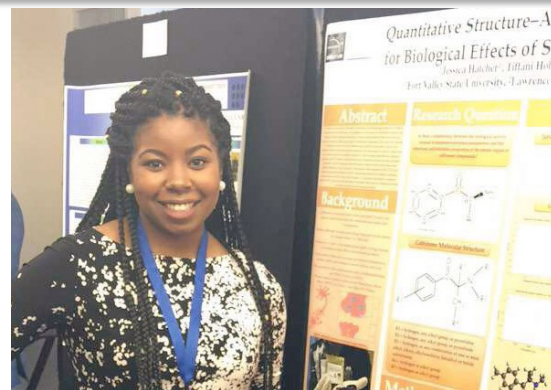
CS Summer Visitor Program Poster Session – August 8th



CS Summer Student Program Poster Session

A great way to practice poster design and presentation

“Leading up to the poster session I was really nervous about presenting and being able to answer any question people might have. But, when it came time to talk about all of the interesting and hard work that our team had been doing I started to just have fun with it by focusing on the topics of interest within the audience and connecting with them through science. This moment best showcased the genuine and collaborative atmosphere at the lab as I felt supported and valued across disciplines, education levels, and experience strengths” **2021 Presenter**



Jessica Hatcher from Fort Valley State University in Georgia won a first-place award for her research poster “at the 74th Joint Annual Meeting of The National Institute of Science / Beta Kappa Chi National Scientific Honor Society

Examples

WHICH IS MORE IMPORTANT: NUMBER OF PATCHES OR CONNECTIVITY?

Darin Kalisak, PBS Student

Contact: dkalisak@unity.ncsu.edu

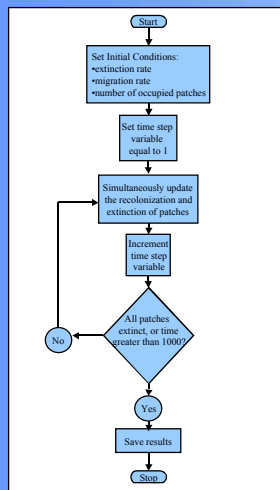
INTRODUCTION AND OBJECTIVES

Metapopulation conservation efforts with limited resources would benefit from a clear understanding of the effects of different conservation strategies, so that the conservationists can decide how to best spend their resources. In particular, in metapopulations with randomly occurring patch extinction and recolonization, it is desirable to know what conservation strategy is more effective: is it better to spend effort to add new patches to the metapopulation, or is it better to spend that effort to facilitate migration between patches?

As an aid to real-life conservation efforts, this model might be useful in weighing various strategies. For example, if the conservation choices for an endangered species are either to buy land to connect existing habitats (increasing connectivity), or to simply work to preserve multiple habitats (increasing number of patches), the model may avoid a solution which is economically preferable but ecologically ineffective.

I developed a simple metapopulation model to investigate this issue. I ran the model using varying numbers of patches, where each patch is considered to be either extinct or occupied, and where every pair of patches is either connected or disconnected for purposes of migration. The whole metapopulation is considered to be extinct if and only if all of the patches are extinct.

THE PROGRAM



ASSUMPTIONS AND LIMITATIONS

- Additional migration pathways were added in a manner which kept the number of pathways for each patch fairly constant. No effort was made to investigate the effects of less symmetric configurations.

- Starting patch habitation was randomly determined, and so the results may not correspond well to specific species metapopulations with known starting conditions.

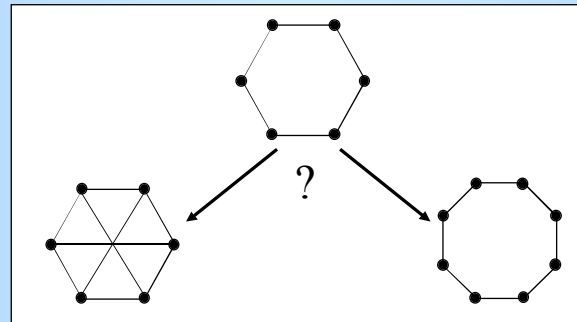
- All patches were assumed to be either fully occupied or extinct, and of equal value to the metapopulation.

- All migration pathways were equivalent, regardless of spatial distances or other factors involved.

- The model had a low resolution for differing probabilities of extinction and migration.

- The model amalgamated results from differing extinction and migration probabilities within a number of patches. It is possible that for specific parameter values, this amalgamation will hide results contrary to the overall trend reported here.

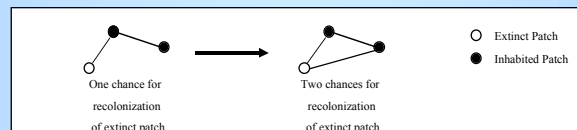
THE ISSUE



A metapopulation is a collection of discrete population patches, in which individual patches may typically go extinct and be recolonized. Is the long-term viability of the metapopulation helped more by adding new patches or by increasing the number of migration pathways between existing patches?

Adding patches increases the overall population of the organism, and makes a total extinction less likely by increasing the sheer number of patches which would have to go extinct.

Adding migration pathways increases the likelihood of recolonization of extinct pathways, by giving extinct patches more sources for immigration.

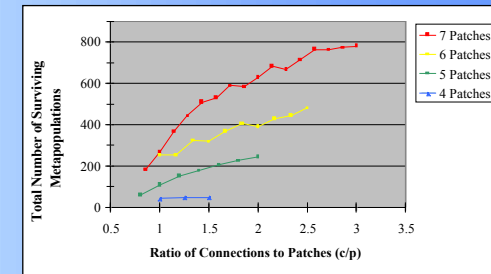


RESULTS

I tested the model by running simulations which varied over four parameters:

- number of patches (values 4, 5, 6, and 7)
- minimally connected to maximally connected (expressed as the ratio of migration pathways to number of patches, or c/p)
- time-step-extinction probabilities of 2, 4, 6, and 8
- time-step-migration probabilities of 2, 4, 6, and 8

For every combination of these parameters, I ran 100 simulations of 1000 time-steps each, and tracked the number of instances out of those 100 runs that the metapopulation did not go extinct. For each number of patches, I then summed the numbers of surviving metapopulations for each connection ratio to obtain a summary value for each patch/pathway configuration. The results are graphed below. The model showed that increasing the number of patches by only one patch had a far greater effect on metapopulation survival than did increasing the connectivity between patches. A horizontal line intersecting two result curves would, at each intersection, show the ratio of connectivity necessary to achieve the same survival rate for each of the two metapopulations. In every case, the metapopulation with the greater number of patches requires a lower connectivity ratio to maintain the desired survival level. In some cases, as with four patches, no increase in connectivity could have the same effect on metapopulation survival as adding a single patch.



CONCLUSIONS

The results of this model indicate that, when possible, adding patches to a metapopulation is far preferable to incremental increases in numbers of migration pathways. There are some cases in which substantial gains in numbers of pathways can improve the long term viability of the metapopulation compared to addition of a patch. When the costs of these additional pathways is relatively low, this may be a good strategy, however in most cases the greatest benefit to the metapopulation will come from adding more patches.

It is worth noting that in our results, the curve for each additional patch is steeper than the last. It may be that the low numbers of patches I tested are an important limit on the effects of connectivity. Simulations using larger numbers of patches may show that increased connectivity can have a greater effect on metapopulation survival than is seen here.

WHICH IS MORE IMPORTANT: NUMBER OF PATCHES OR CONNECTIVITY?

Darin Kalisak, PBS Student

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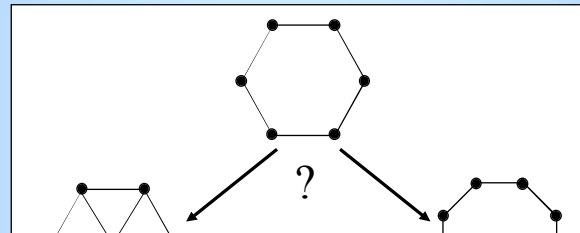
INTRODUCTION AND OBJECTIVES

Metapopulation conservation efforts with limited resources would benefit from a clear understanding of the effects of different conservation strategies, so that the conservationists can decide how to best spend their resources. In particular, in metapopulations with randomly occurring patch extinction and recolonization, it is desirable to know what conservation strategy is more effective: is it better to spend effort to add new patches to the metapopulation, or is it better to spend that effort to facilitate migration between patches?

As an aid to real-life conservation efforts, this model might be useful in weighing various strategies. For example, if the conservation choices for an endangered species are either to buy land to connect existing habitats (increasing connectivity), or to simply work to preserve multiple habitats (increasing number of patches), the model may avoid a solution which is economically preferable but ecologically ineffective.

I developed a simple metapopulation model to investigate this issue. I ran the model using varying numbers of patches, where each patch is considered to be either extinct or occupied, and where every pair of patches is either connected or disconnected for purposes of migration. The whole metapopulation is considered to be extinct if and only if all of the patches are extinct.

THE ISSUE



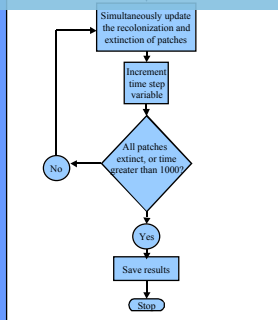
RESULTS

I tested the model by running simulations which varied over four parameters:

- number of patches (values 4, 5, 6, and 7)
- minimally connected to maximally connected (expressed as the ratio of migration pathways to number of patches, or c/p)
- time-step-extinction probabilities of .2, .4, .6, and .8
- time-step-migration probabilities of .2, .4, .6, and .8

For every combination of these parameters, I ran 100 simulations of 1000 time-steps each, and tracked the number of instances out of those 100 runs that the metapopulation did not go extinct. For each number of patches, I then summed the numbers of surviving metapopulations for each connection ratio to obtain a summary value for each patch/pathway configuration. The results are graphed below. The model showed that increasing the number of patches by only one patch had a far greater effect on metapopulation survival than did increasing the connectivity between patches. A horizontal line intersecting two result curves would, at each intersection, show the ratio of connectivity necessary to achieve the same survival rate for each of the two metapopulations. In every case, the metapopulation with the greater number of patches requires a lower connectivity ratio to maintain the desired survival level. In some cases, as with four patches, no increase in connectivity could have the same effect on metapopulation survival as adding a single patch.

- Too many large text blocks, Some issues about flow (solution stated before problem), Poor color contrast in some sections, Some unlabeled figures, A cut-and-paste from Excel, but
- A reasonable overall balance and format, clear titles



•All patches were assumed to be either fully occupied or extinct, and of equal value to the metapopulation.

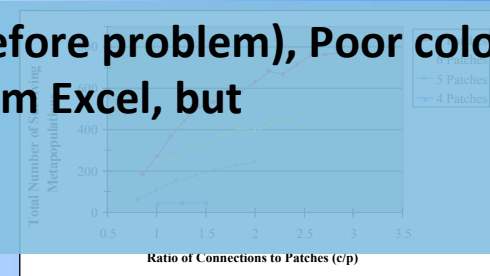
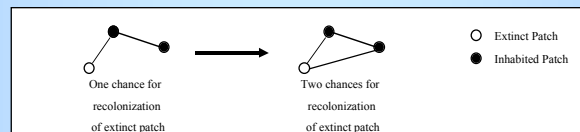
•All migration pathways were equivalent, regardless of spatial distances or other factors involved.

•The model had a low resolution for differing probabilities of extinction and migration.

•The model amalgamated results from differing extinction and migration probabilities within a number of patches. It is possible that for specific parameter values, this amalgamation will hide results contrary to the overall trend reported here.

Adding patches increases the overall population of the organism, and makes a total extinction less likely by increasing the sheer number of patches which would have to go extinct.

Adding migration pathways increases the likelihood of recolonization of extinct patches, by giving extinct patches more sources for immigration.



CONCLUSIONS

The results of this model indicate that, when possible, adding patches to a metapopulation is far preferable to incremental increases in numbers of migration pathways. There are some cases in which substantial gains in numbers of pathways can improve the long term viability of the metapopulation compared to addition of a patch. When the costs of these additional pathways is relatively low, this may be a good strategy, however in most cases the greatest benefit to the metapopulation will come from adding more patches.

It is worth noting that in our results, the curve for each additional patch is steeper than the last. It may be that the low numbers of patches I tested are an important limit on the effects of connectivity. Simulations using larger numbers of patches may show that increased connectivity can have a greater effect on metapopulation survival than is seen here.



PIGS IN SPACE: EFFECT OF ZERO GRAVITY AND AD LIBITUM FEEDING ON WEIGHT GAIN IN CAVIA PORCELLUS



SPACEEXES

Colin B. Purrington

6673 College Avenue, Swarthmore, PA 19081 USA

ABSTRACT:

One ignored benefit of space travel is a potential elimination of obesity, a chronic problem for a growing majority in many parts of the world. In theory, when an individual is in a condition of zero gravity, weight is eliminated. Indeed, in space one could conceivably follow ad libitum feeding and never even gain an gram, and the only side effect would be the need to upgrade one's stretchy pants ("exercise pants"). But because many diet schemes start as very good theories only to be found to be rather harmful, we tested our predictions with a long-term experiment in a colony of Guinea pigs (*Cavia porcellus*) maintained on the International Space Station. Individuals were housed separately and given unlimited amounts of high-calorie food pellets. Fresh fruits and vegetables were not available in space so were not offered. Every 30 days, each Guinea pig was weighed. After 5 years, we found that individuals, on average, weighed nothing. In addition to weighing nothing, no weight appeared to be gained over the duration of the protocol. If space continues to be gravity-free, and we believe that assumption is sound, we believe that sending the overweight — and those at risk for overweight — to space would be a lasting cure.

INTRODUCTION:

The current obesity epidemic started in the early 1960s with the invention and proliferation of elastane and related stretchy fibers, which released wearers from the rigid constraints of clothes and permitted monthly weight gain without the need to buy new outfits. Indeed, exercise today for hundreds of million people involve only the act of wearing stretchy pants in public, presumably because the constrictive pressure forces fat molecules to adopt a more compact tertiary structure (Xavier 1965).

Luckily, at the same time that fabrics became stretchy, the race to the moon between the United States and Russia yielded a useful fact: gravity in outer space is minimal to nonexistent. When gravity is zero, objects cease to have weight. Indeed, early astronauts and cosmonauts had to secure themselves to their ships with seat belts and sticky boots. The potential application to weight loss was noted immediately, but at the time travel to space was prohibitively expensive and thus the issue was not seriously pursued. Now, however, multiple companies are developing cheap extra-orbital travel options for normal consumers, and potential travelers are also creating new ways to pay for products and services that they cannot actually afford. Together, these factors open the possibility that moving to space could cure overweight syndrome quickly and permanently for a large number of humans.

We studied this potential by following weight gain in Guinea pigs, known on Earth as fond of ad libitum feeding. Guinea pigs were long envisioned to be the "Guinea pigs" of space research, too, so they seemed like the obvious choice. Studies on humans are of course desirable, but we feel this current study will be critical in acquiring the attention of granting agencies.

MATERIALS AND METHODS:

One hundred male and one hundred female Guinea pigs (*Cavia porcellus*) were transported to the International Space Laboratory in 2010. Each pig was housed separately and deprived of exercise wheels and fresh fruits and vegetables for 48 months. Each month, pigs were individually weighed by duct-taping them to an electronic balance sensitive to 0.0001 grams. Back on Earth, an identical cohort was similarly maintained and weighed. Data was analyzed by statistics.

RESULTS:

Mean weight of pigs in space was 0.0000 +/- 0.0002 g. Some individuals weighed less than zero, some more, but these variations were due to reaction to the duct tape, we believe, which caused them to be alarmed push briefly against the force plate in the balance. Individuals on the Earth, the control cohort, gained about 240 g/month ($p = 0.0002$). Males and females gained a similar amount of weight on Earth (no main effect of sex), and size at any point during the study was related to starting size (which was used as a covariate in the ANCOVA). Both Earth and space pigs developed substantial dewlaps (double chins) and were lethargic at the conclusion of the study.

CONCLUSIONS:

Our view that weight and weight gain would be zero in space was confirmed. Although we have not replicated this experiment on larger animals or primates, we are confident that our result would be mirrored in other model organisms. We are currently in the process of obtaining necessary human trial permissions, and should have our planned experiment initiated within 80 years, pending expedited review by local and Federal IRBs.

ACKNOWLEDGEMENTS:

I am grateful for generous support from the National Research Foundation, Black Hole Diet Plans, and the High Fructose Sugar Association. Transport flights were funded by SPACE-EXES, the consortium of wives divorced from insanely wealthy space-flight startups. I am also grateful for comments on early drafts by Mañana Athletic Club, Corpus Christi, USA. Finally, sincere thanks to the Cuy Foundation for generously donating animal care after the conclusion of the study.

LITERATURE CITED:

- NASA. 1982. Project STS-XX: Guinea Pigs. Leaked internal memo.
- Sekulić, S.R., D. D. Lukač, and N. M. Naumović. 2005. The Fetus Cannot Exercise Like An Astronaut: Gravity Loading Is Necessary For The Physiological Development During Second Half Of Pregnancy. *Medical Hypotheses*. 64:221-228
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- Too many large text blocks
- Text confused with background
- Randomly sized and colored boxes
- Annoying logos
- Cutesy and hard-to-read title



{ NEXT GEN SEQUENCING }
 millions of reads
 hard to completely assemble

{ FRAGMENTED ASSEMBLIES }
 repeat regions difficult to bridge
 uneven read coverage

{ REQUIRE FINISHING }
 join contigs together
 trim nucleotide sequences
 add PCR sequences

{ FINISHING ERRORS }

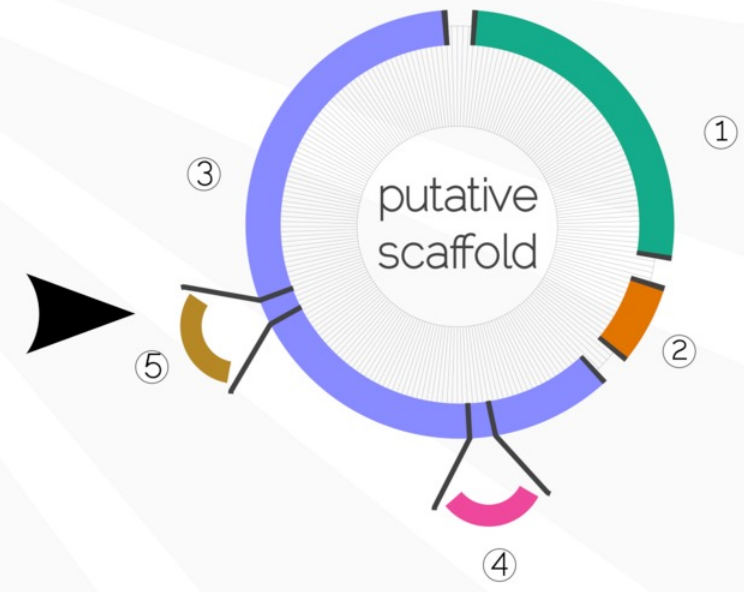
- [human-error]**
manually joining contigs and trimming sequences can introduce errors
- [unreproducible]**
manually editing a sequence can't be repeated by anyone else
- [hard to change]**
large blocks of nucleotide sequence are hard to update and determine the source contig

scaffolder

microbial genome scaffolding software
<http://next.gs>

michael d barton*, hazel a barton
 northern kentucky university

```
scaffold file
-
① sequence:
  source: 'sequence1'
-
② unresolved
  length 20
-
③ sequence:
  source: 'sequence2'
  start 30
  stop 1000
  reverse: true
  inserts:
-
  source: 'insert1'
  start 8
  stop 160
  reverse: true
  open: 200
  close: 250
-
④
  source: 'insert2'
  open: 400
⑤
```



reproduce
 remove human-error and scaffolds can be reliably reproduced from the same data

separate
 separate sequence from the scaffold organisation and preserve the original assembly data

edit
 easier to edit the scaffold file compared with raw nucleotide sequence

visualise
 provides an overview of the genome construction and allows easier comparisons of differences in scaffolds

{ NEXT GEN SEQUENCING }
 millions of reads
 hard to completely assemble

{ FRAGMENTED ASSEMBLIES }
 repeat regions difficult to bridge
 uneven read coverage

{ REQUIRE FINISHING }
 join contigs together
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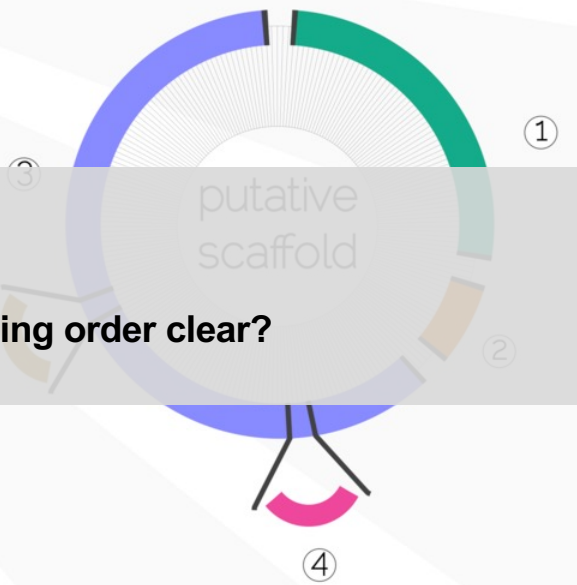
- Text font hard to read
- Good balance between text and graphics
- Good color contrast
- Organization of poster reflects organization of project, but is the reading order clear?

[human-error]
 manually joining contigs and trimming sequences can introduce errors

[unreproducible]
 manually editing a sequence can't be repeated by anyone else

[hard to change]
 large blocks of nucleotide sequence are hard to update and determine the source contig

```
scaffold file
① sequence:
  source: 'sequence1'
② unresolved
  length 20
③
④ start 8
  stop 160
  reverse: true
  open 200
  close 250
⑤ source: 'insert2'
  open 400
```



reproduce	separate	edit	visualise
remove human-error and scaffolds can be reliably reproduced from the same data	separate sequence from the scaffold organisation and preserve the original assembly data	easier to edit the scaffold file compared with raw nucleotide sequence	provides an overview of the genome construction and allows easier comparisons of differences in scaffolds