How to Lead a Technical Reading Group

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I. Introduction

This paper explains the role of a technical reading group leader, provides resources for reading and finding technical papers, and suggests strategies for facilitating a discussion. It emphasizes the importance of feedback and brings up pitfalls and issues that have come up in recent semesters. Now with 14 reading groups worth of experience spanning 5 academic departments at MIT, we detail the key ingredient for making reading groups work and other successful strategies. As you lead your reading group, keep this document handy as a reference.

II. Motivation

This paper grew out of a desire for more relevant but similarly meta training material for Undergraduate Reading Group Experience (URGE)[1] reading group leaders. URGE, although still in its infancy, has achieved recognition by *TheInstitute*, the IEEE newspaper[2], and is being adopted by other top engineering schools. The lack of similar programs calls for training material tailored for *undergraduates* seeking to lead *technical* groups.

Historically (Fall 2011), a paper titled "How to Read a Paper" (see Appendix A) was used for training, which is still a great resource. However, since a majority of reading group leaders will already be experienced at reading technical papers, the selection was meta but not extremely insightful for the audience. Since Spring 2011, we have accumulated 14 undergraduate technical reading groups worth of experiences to share.

As a cautionary note, this program grew out of an effort to promote technical reading at an undergraduate level within the field of Electrical Engineering and Computer Science (EECS). As such, despite an attempt to provide training that is relevant to all technical fields, some of the tips may be more relevant to EECS and related fields.

III. So, what's in it for you

First and foremost, as a technical reading group leader, you have the opportunity to explore a technical area of interest with

similarly interested and motivated students. URGE recognizes that your primary objective is to delve deep, learn, blabber on about your technical topic, and get to know others with this interest. The infrastructure of URGE does its very best to allow you to achieve this without all the hassles of leading something – that is, determining who/when/where/how/food. (We *do* ask you to determine the "what" and the "why.")

As an added bonus, you will also learn through experience how to lead a technical reading group and facilitate discussions. You will become awesome at asking the right questions, moving the discussion along, and summarizing information. You will also become awesome at getting the members of your reading group to do the same. Being able to articulate and explain ideas is the true test of having learned something, and URGE also provides you with an opportunity to test your understanding.

IV. Your Role

Your main roles as the leader of your technical reading group are to:

Find appropriate reading material for your topic You have full control over the direction of your reading group, be it more theoretical or more applied. During the first few meetings, you may want to ask your group what they would like to see more of and see where there is interest (discussed more in Section V). Getting feedback from the group is always a good way to keep them engaged and interested (discussed further in Section VII).

Facilitate discussions Simply put, it is your job to have everyone (yourself included!) leave the meeting understanding the main ideas of the reading and having learned something (discussed more in Section VI.

Make sure that your reading group happens Delegate! Starting day 1! Unless you want to, you shouldn't be doing *any* of the logistical work. Each of the members of your group should be contributing (a little bit!) to the running of your group.

Let URGE staff know how things are going A member of URGE staff may sit in on some of your meetings to see how things are going and if you need anything. Additionally, there will be evaluation forms. URGE staff is here to find problems and fix them, so please help out and bring up issues when they come up. Always feel

free to email the staff list (rg-staff@mit.edu) if there's anything on your mind.

V. Finding Technical Papers

There are a wealth of possibilities when it comes to finding readings for your meetings. We encourage you to be creative! Here we have compiled some ways and suggestions that we have found to work.

A. Ways to find technical material

Professor suggestions Perhaps the least work and most effective method is directly asking professors in the field for paper suggestions. Ideally, they send you 5 canonical papers in the field and you are done for the semester, but they will often take a long time to reply. Professors *are* generally interested in helping out, so email them or find them! Often times, they can immediately suggest 1-2 papers that come to mind and send you on your merry way. If they are taking a long time to get back to you, you may want to request that they just send a few titles that come to mind and thank them for their time.

Suggestions from graduate students working in the field
Graduate students, especially those in their first or second year, will know what papers to read to get ramped up, what papers helped, what papers are field-defining. These graduate students just entered their field not too long ago, and a lot of them are happy to share with bright-eyed kids just coming in. They may even have a bit more time than professors.

Class readings Find classes on your topic and look through the reading list. You may strike gold.

Canonical papers, tutorial papers in the field Material with a lot of citations and recommendations or written by a well-respective author are generally good choices. People are generally happy to read papers that are widely cited. Often-times, papers are cited a lot because they were well-written too. It's a win-win for everyone. Tutorial papers will often present a technique, explain the underlying theory and why it works, and then demonstrate a few examples and applications. Tutorial papers were *made* for learning and so are candidate choices.

Important patents, theses, excerpts from technical books
Everything is fair game for reading materials, as long as its relevant to your topic of choice.

Literature survey Performing a literature survey involves a lot of work, but you will undoubtedly get a good sense of the field this way and will be able to then identify papers that are key to the field. "How to Read a Paper" gives a good description of how to go about performing a literature survey:

> Paper reading skills are put to the test in doing a literature survey. This will require you to read tens of papers, perhaps in an unfamiliar field. What papers should you read? Here is how you can use the three-pass approach to help.

First, use an academic search engine such as Google Scholar or CiteSeer and some well-chosen keywords to find three to five recent papers in the area. Do one pass on each paper to get a sense of the work, then read their related work sections. You will find a thumbnail summary of the recent work, and perhaps, if you are lucky, a pointer to a recent survey paper. If you can find such a survey, you are done. Read the survey, congratulating yourself on your good luck. Otherwise, in the second step, find shared citations and repeated author names in the bibliography. These are the key papers and researchers in that area. Download the key papers and set them aside. Then go to the websites of the key researchers and see where they've published recently. That will help you identify the top conferences in that field because the best researchers usually publish in the top conferences.

The third step is to go to the website for these top conferences and look through their recent proceedings. A quick scan will usually identify recent high-quality related work. These papers, along with the ones you set aside earlier, constitute the first version of your survey. Make two passes through these papers. If they all cite a key paper that you did not find earlier, obtain and read it, iterating as necessary.

Personal library If you have collected relevant materials over the months/years and you just have not had the chance to delve into them deeply, this is a great opportunity to revisit them.

B. General tips for reading materials

These tips were adapted from the URGE wiki[3].

- Choose readings that will be academically accessible to students with the prerequisites you set for the group. It is often easy to forget how much you may know about a subject, so keep in mind that your participants may not know as much about the area (and the relevant prerequisites) as you do.
- Aim for a length between 8 and 40 pages. Typical paper lengths can vary a lot between fields, but in general shorter ones will not have enough material to talk about for an 1.5 hours, and longer ones will be too time-consuming to read. If you wish to assign a very long reading, try to identify the most important sections of it, and only assign those sections. This is especially true for readings from theses and book chapters. You may also consider assigning 2 short papers.
- Make sure to select papers that provide good overall coverage of your subject area. In general, breadth is better than depth. If your subject is number theory, but you choose five papers that are all about RSA, you're doing

[3]http://ieee.scripts.mit.edu/urgewiki/index.php?title=How_to_be_a_ Reading_Group_Leader#Choosing_Papers

it wrong. (If your subject was RSA, then this would be ok.) Select papers that are about lots of different things within your group's focus area.

- Try to make sure that most of the readings either discuss a particularly important result in your field, or are survey papers or review papers that have broad emphases. Again, the point is to give participants a good overall view of your subject area, and make sure that they don't get lost in random details and unimportant results.
- Make sure that your readings thoroughly explain their methods, if applicable. If you're well-versed in your area but you don't feel that a given paper used enough detail for you to fully understand it / implement it / replicate its result / etc., it might not be a good choice.
- Ask your group participants for feedback on the papers selected and if they have any suggestions for future papers.

VI. FACILITATING DISCUSSION

As a facilitator, you should be more familiar with the papers than if you were simply in the group. That said, you don't need to know everything. Just like everyone else in your group, you should not hesitate to ask any questions you may have.

In any reading group, you can expect a maximum of 50% to participate actively, 20% to talk sometimes, and 30% to never talk[4], so do not get discouraged if some people just do not speak! That said, all three technical reading groups in my experience have been much closer to 80-90% participation, and you can achieve this too, using some of the strategies below.

A. The Key Ingredient

At the start of the meeting, ask/make/force everyone ask 2 questions at the beginning and write them on a white board if possible[5]. At this time, welcome any and all questions. Try to prevent members of the group from jumping in and answering them right away because these questions form an outline for the discussion. Then, use the awkward silence to your benefit, to get more questions asked and put on the board.

With these questions, all the participants now have a stake in the discussion and wants their questions answered. Importantly, this approach communicates to participants that they are allowed to *not* understand parts of the paper, but that they must read carefully enough to have questions. **This is the secret to making reading groups work.** You may also ask your participants to post their questions on the wiki, on a Piazza for your reading group, or via email before the meeting time.

B. General tips for facilitating discussion

These tips were adapted from the URGE wiki[6].

- The first question you discuss can simply ask for the big picture and summary of the reading material. This is to

make sure that everyone understands the overall structure. You may find it useful to prepare 1-2 big picture questions relevant to the specific reading to get everyone's minds moving and get the discussion going.

- Look out for and cut off discussions that seem to be wandering or not gaining much progress. Steer discussion toward the material rather than random distractions or irrelevant comments. If you are not wary for this, you may easily lose half an hour to a discussion on trivial details and everyone will be unhappy with it afterwards.
- Make sure your group is able to discuss the entire reading within the scheduled meeting time if possible and respect that people have other things they need to do when the time is up, but definitely allow further discussion if there is interest.
- Encourage everyone to talk. We want to see an increase in participation as the semester progresses, as opposed to a decrease.
- Ensure that no particular group member dominates the discussion. This includes you, of course.
- Always promote questions, especially the kind that lead to further discussion and insights.
- Generally maintain lexical order in the discussion. Go from the beginning to the end of the reading. Try to avoid skipping arbitrarily between pages. However, it is definitely ok to use the last part of discussion to go back to particular details or to talk about broader subjects – you should not feel completely bound by page numbers.
- Awkward silence is an indication to go onto the next question on the board!
- Have a laptop available for reference when papers refer to things your group is not familiar with. Use it to look them up for background information when necessary during discussions.
- If you believe a discussion could benefit from the participation and insight of a professor, research scientist, etc., you are welcome to invite them.
- A good closing question is what the group thought of the paper. This is also a great way to get feedback on your material selection, topic choice, discussion, etc.

VII. FEEDBACK

Asking for feedback is without a doubt the easiest and most effective way to find and fix problems. As a young organization, URGE not only needs feedback, but cares extremely about feedback at all levels and works to iterate on it. At the level of an individual reading group, you will find that just doing a little bit to ask for and iterate on feedback from your group's members will go a long way in keeping the group focused and happy.

Anecdotally, asking for feedback at the end of each meeting is also a great way for the group to wind down after a technical discussion and provides an opportunity to get to know one another and make friends! In Spring 2011, during our pilot program, in addition to dinner, we also bought dessert but only offered it to group members who stayed afterwards to

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[4]In Professor Polina Golland's 10+ years of reading group experience.

[5]This suggestion from Professor Polina Golland that has worked wonders in past reading groups

[6]http://ieee.scripts.mit.edu/urgewiki/index.php?title=How_to_be_a_Reading_Group_Leader#Guiding_Discussions

give us feedback on the session. We not only got extremely useful feedback, but after a couple sessions, nearly the entire group was staying after for an additional half-hour or hour, giving feedback and just chatting, *not* even eating the dessert! You are more than welcome to try this too.

Towards the end of the program, there will be an evaluation form for both leaders and participants, and we look forward to learning from them! Please encourage your group members to fill it out as well.

VIII. LIMITATIONS

The involvement of URGE staff can only go so far, and we rely on you as reading group leaders to resolve some key issues that have surfaced in recent semesters. In this section, we identify the issues.

A. Lack of direction for the reading group

In the past, students have voiced concerns about a lack of direction for their reading group, not knowing what the group discussion is trying to achieve. We believe that this can be aided by selecting a goal and simply telling the group at the start of a meeting what it is that they should be trying to do during the discussion and why. For example, this goal can be as simple as understanding the main technique used in a paper because it is extremely useful or applicable to problems in the field. Alternatively, the goal can be understanding the application in the paper because it achieved some interesting result or made good use of available tools. We encourage you to seek out a goal for the discussion based on the reading material. Participants need not reach the goal while reading the paper, but the goal will give the entire discussion a general focus.

B. Student participation issues in discussions

Another complaint is that discussion is often from a few students in the group. This is as expected, but we encourage you to continue to pressure everyone into speaking until everyone is comfortable with it (this is a tried and true method).

On the flip side, we would also like you to watch out for people to are speaking too much, potentially dominating the discussion and thereby discouraging discussion.

Other students have felt that the discussion is sometimes pedantic and unproductive because students are at different levels and have different understandings. Unfortunately, this is to be expected in a group of undergraduates tackling graduate-level (and beyond) topics.

To alleviate these problems, we suggest 1) starting with a slightly easier (less technical) paper to get everyone talking and more comfortable, and 2) providing additional readings and outside resources for getting the members of your group up to speed to the level with which you would like to run your group.

IX. FUTURE WORK

A. A note on co-leading

In past semesters, leaders have in a few cases found that doing a literature survey takes a lot of time and thus it helps to be able to switch off between sessions who is selecting the reading material. URGE is now encouraging the co-leading of reading groups. If you are co-leading a group, it is up to you how you would like to divide up responsibility. However, we encourage you to determine at the start of the program who is doing what and when, so that all the responsibilities are clear when the term gets more hectic.

If you've lead a technical reading group before, then you're ready for anything [involving reading groups].

B. Professional mentors

This semester, we will be working with each of you to find mentors from academia and/or industry for your reading group. We encourage your suggestions as to who you would like to get involved and what you would like them to do. You are welcome to invite faculty, research scientists, industry professionals, etc. on your own to your meetings as well.

We have a few ideas in mind as to how to involve them: 1) a mentor who is as involved as a one-time (or multi-time) participant, who does the reading(s) and attends the associated meeting(s), contributing insights from their work, or 2) a mentor who looks over your reading list at the start of the semester or throughout the semester and offers suggestions. This is a great opportunity for you to get to know professionals who are working in your topic of interest.

C. Lightning talks

A test of whether or not you have learned something is being able to explain it to someone else. Just keep in mind that URGE closes the semester with a series of Lightning Talks given by each group, where you share a bit of what you learned and inspire more students to learn your topic of interest. You and/or someone else in your group may give this talk, but you should keep in mind that at the end of the day, you want to be able to explain what your group has learned throughout the semester.

D. New strategies

This is a living document based on a solid but still small number of reading groups. As reading group leaders, we encourage you to try strategies of your own and would love to add your wisdom and experience as you acquire them. Please let us know if and when you would like to submit any modifications or additions to this paper.

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X. CONCLUSION

Your primary job as a technical reading group leader of URGE is to learn, have fun, have some free food, and make some friends. We hope that along the way, you will learn how to lead a technical reading group and how to facilitate discussions. We know that you will all be pros at finding and evaluating reading materials by the end. Please let us (rg-staff@mit.edu) know at any time if we can be of any help.

APPENDIX
TECHNICAL READING RESOURCES

These are great resources to pass on to the members of your reading group if you find that they could use a different methodology for going through technical papers. Depending on the length and density of your selected readings, you may find some members complaining that they were not able to make it through the reading. This is a sign that they are not strategizing properly.

How to Read a Scientific Research Paper [7]

A 1-page guide to getting the gist of a technical paper, along with a bunch of helpful guiding questions. These questions are also great ways to start the discussion.

How to Read a Paper [8]

A three-pass approach to reading technical papers for understanding a paper well enough to implement it (or close).

Formerly, this was part of the leader training material, but we have determined that this is perhaps more useful to the members of your group than to you. It does include, however, useful tips going doing a literature survey, which is a good way to find reading material.

[7] https://www.msu.edu/~luckie/paris/290B/readingpaper.pdf
[8] http://blizzard.cs.uwaterloo.ca/keshav/home/Papers/data/07/paper-reading.pdf