Hip-Hop Network Lesson Plan

Purpose

Using a context that most students are already familiar with, hip-hop, the learners construct an abstraction (a network diagram) of the relationships between hip-hop artists. Then, given the abstraction they have created (and a much larger scale one available by researchers) the students hypothesize about the implications of the structure of the abstraction. Some of the main ideas are:

- We can represent almost anything as an abstraction, even hip-hop artists.
- We can use mathematical tools (nodes, edges, networks) to represent these abstractions and learn about the relationships.
- We can then conjecture using the results of our abstraction and think about how well this maps back to what we know in the real world.

Furthermore, network diagrams (and network science) are becoming an increasingly popular mode for studying complex interactions of actors in both the hard and the social sciences. Introducing students to the tools and ideas used will help them understand and make sense of network diagrams, when they encounter them in a non-academic setting. For example, most students encounter a network every day when they log on to Facebook or social networking websites. The end of the lesson comes with a handout to guide students in accessing their own network diagram from Facebook.

Overview

Students will use their preexisting knowledge about music to construct a network diagram of hip-hop collaborations. Using this network, students can hypothesize about what various network structures imply about the relationships between artists and the hip-hop industry. We can test some of these hypotheses (and not test others) and ask basic questions about research methodology.

Student Outcomes

Learner Objectives

- Students should be able to represent relationships or interactions as nodes and edges in a network. Given some set of interactions (such as hip-hop collaborations) the student should be able to draw a network diagram.
- Students should construct hypotheses pertaining to various aspects of the network structure. For example, do specific network structures imply some other result?

State Standards

The below applicable standards are from Illinois Learning Standards

- 11.A.3a Formulate hypotheses that can be tested by collecting data.
- 11.A.4a/11.A.5a Formulate hypotheses referencing prior research and knowledge.

The below standards are from the AAAS. Note that the standards are interdisciplinary – coming from not just science and math but also the social sciences.

- 2B/H3 Mathematics provides a precise language to describe objects and events and the relationships among them. In addition, mathematics provides tools for solving problems, analyzing data, and making logical arguments.
- 2B/H6 Mathematics is useful in business, industry, music, historical scholarship, politics, sports, medicine, agriculture, engineering, and the social and natural sciences

Learning Performances (Rubric)

The following are the learning performances (Krajcik, et al) that are expected of the student from this lesson:

- After observing a network diagram, students should be able to identify the abstraction represented by the nodes & edges. In the case of the hip-hop network, students should be able to draw their own diagram, from memory using artists they are familiar with.
- After observing the complete hip-hop network diagram, students should construct hypotheses about various aspects of network structure and observable features in the network. Students should hypothesize about the definition of clusters and groups of similar artists.
- Students should be able to present ideas about how they observe networks in their every day experiences and move from reality (people, computers, etc) to abstraction (nodes).

Performance Rubric

Below is the performance rubric which can be used to assess student performance.

Element	1 (Struggling)	2 (Learning)	3 (Proficient)
Constructing a network	(this is a binary variable, either the student is proficient or not at all?)	=>	Given some problem or basic data, student is able to draw the nodes and edges, where the nodes represent discrete entities.
Abstracting Networks in the Real World	Student are able to identify networks, such as the Internet (using the common definition of computer networks)	Student are capable of understanding basic social network ideas, like Facebook as a network where your friends are abstractions	Student is able to identify the complex interactions and networks that occur in all sorts of daily transactions (not just social or computer networks)
Thinking structurally about the abstraction	Student is able to identify basic network structure elements like such as connectedness (is it one big connected network or many?)	Student is able to identify basic network metrics such as centrality.	Student identifies structural signatures from the network such as different notions of centrality, network density, or clustering.
Forming hypotheses pertaining to these abstractions	Student can form basic if-then hypothesis.	Student forms basic hypothesis about network structure and the abstracted entites. For example: there is correlation between centrality and importance.	Student can relate concepts from network structure to exogeneous data. For example: there is correlation between centrality and # of albums sold.

Time

The minimum amount of time for this activity is 20 minutes but more time allows for the instructor (or students) to build a more robust model on their own. Ideally, a 60 minute time period would be optimal.

Level

Grade 6-12 grade math, science, and computer science.

Material and Tools Necessary

The primary tool needed is just a whiteboard or a blackboard. However, with access to a computer - you can pull up websites and refer to network visualizations. Sometimes it may be helpful to load examples of other networks.

Background Necessary & Preparation

There are two different aspects of background necessary for the teacher in this lesson. The first is a basic understanding of the structure of networks. For example, what does a network look like? What do the “nodes” represent and what do the “links” in the network represent. There is a lot of very good information about this available on the Internet, so I refer to those sources. The main idea the teacher needs to be aware of is that: nodes are an abstraction of some discrete object (a rapper, a freeway intersection, a subway platform, etc) and the links represent some relation between the the nodes. Usually the the links are associated with a defined phrase. In the case of the hip-hop network, the link represents something akin to “collaborated with”. So, if there are two nodes with a link, we can say that “x collaborated with y”. Mathematicians call these links “binary relations” since they are either 1 (yes the collaborated) or 0 (no, they didn’t).

On the hip-hop side, the teacher may find it useful to review the top 40 or top 100 charts available from the metrics firm, Billboard. You can find the list at
http://www.billboard.com/charts/hot-100#/charts/hot-100
http://www.billboard.com/charts/hot-100#/charts/r-b-hip-hop-songs

It may be helpful just to go through the top 40 and construct your own network. You'll find that the students will probably build something pretty similar to that - unless they have some deep knowledge about connections between rappers and obscure knowledge.

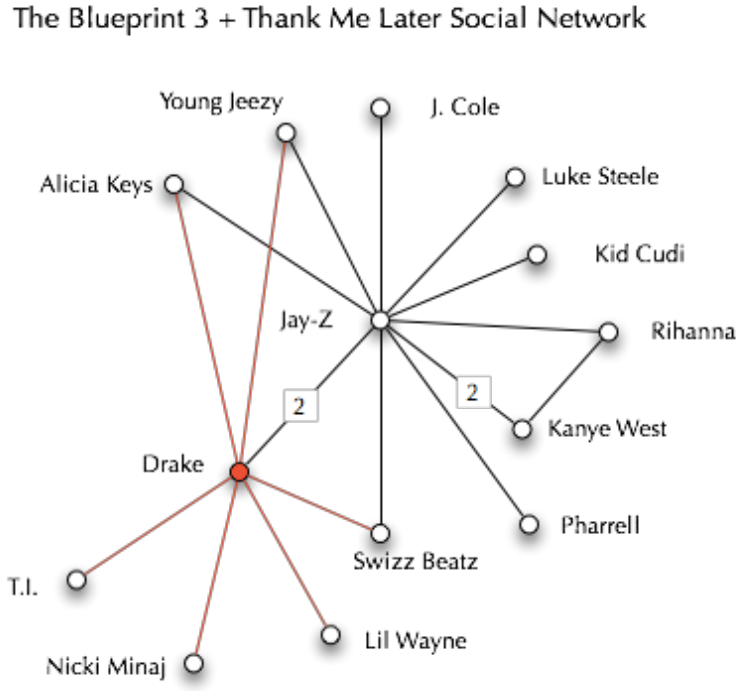
Teaching Notes

There are multiple ways to teach this lesson. The first method is collaborative; the students work directly with the teacher in constructing the network. The second is individual, where the students work on their own to construct networks of their interest. The first option is preferred in the case where most of the students have a fairly homogeneous interest in hip-hop. The second case is preferred where students may have more heterogeneous preferences for music. It is certainly plausible that you may have students not interested in hip-hop, however many of the same processes can be done for other genres of music. However, note that there is less collaboration in other genres, so the resultant networks may be considerably smaller. First, we'll go over the teacher-driven model:

Teacher Driven Model

In this model, the teacher, in front of the class explains the basic tools for constructing a network. Draw a circle on the board and identify that as a "node". Draw another circle adjacent to it and identify this as a "node" as well. Give them names and draw a line between the two and indicate that the line segment represents something. If the two nodes are cities, the line could represent a road. Perhaps the two nodes might be people and the line represents that they are friends. This might take a few minutes and students may have questions.

Then, bring up hip hop and ask, "Think of a song that is popular right now that has more than one person collaborating on the song. Who are they?" The students will probably provide an answer. Abstract this answer into nodes and links on the board. Pick one of the nodes and ask if the students know any other songs this person has collaborated on. Continue this process. You might end up with something that looks like the below (which is two popular albums from 2011 combined together). If two artists collaborate more than once, you can write a number on the link, making it have a heavier "weight" than the other links.

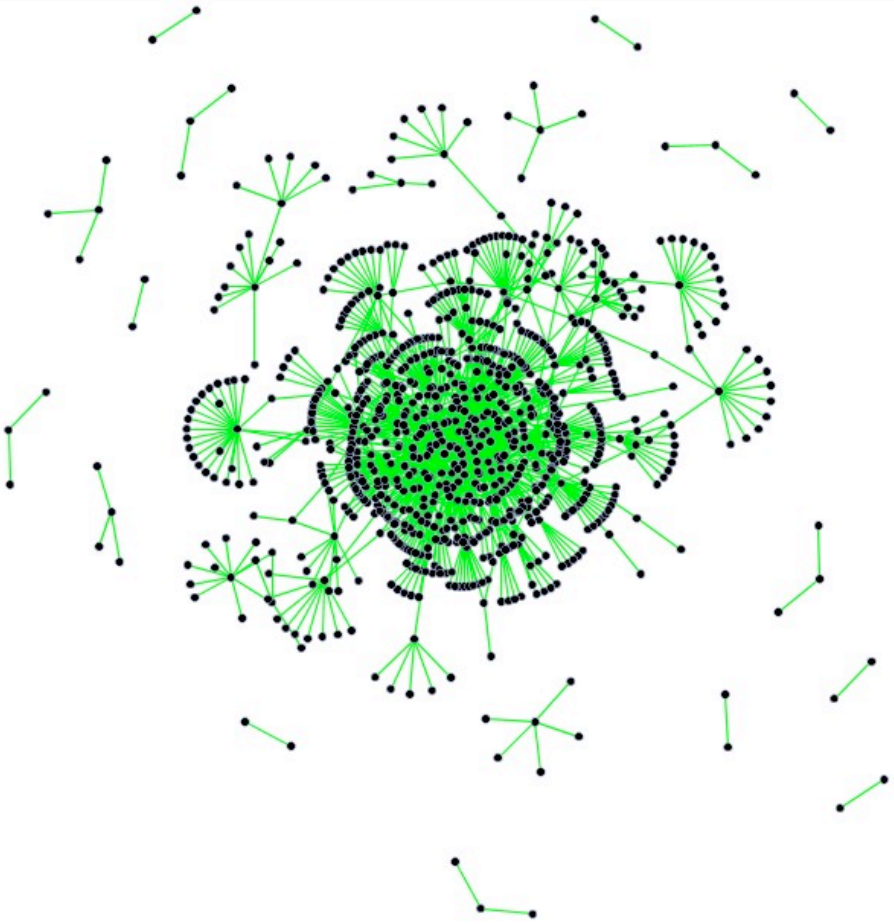


It might not take very long before the entire board is full of a really messy and complicated network diagram. This is essentially what social networks researchers do everyday but they use computerized techniques, since it gets kind of

messy. [Interesting side node: the original networks researchers did used to do this by hand and would fill up entire rooms with network diagrams drawn on the floors].

Student Driven Model
This is basically the same as the above model, however rather than having the class build a complicated network together, it might be better to have to students build their own. This would be especially useful in a diverse classroom where students may have heterogeneous preferences for music - i.e. they like different genres. Most students should be able to construct a network of their own in 10 minutes, and fill up an entire sheet of paper. If it seems like they are going slower, try to construct your own musicTal network with music that you like while the students do theirs.

Post Model Construction
After the students or class has constructed their model, you can then present some of the actual research results and the network diagram for the entire genre, which looks something like:



Data & Actual Hip-Hop Network Results

This part is a work in progress...

Contact Information

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