KEYWORDS, CREATIVITY, CONTEXT (FINAL REVIEW)

COLTON GRAINGER (MATH 1300)

1. KEYWORDS

In *16 short academic weeks*, we have developed a sophisticated vocabulary for *Single-Variable Calculus*. We have gone through a fierce struggle to get at the 'correct' interpretation of the following **keywords:**[1]

> **functions**, **limits**, **derivatives**, **trigonometry**, **hypotheses testing**, **implicit differentiation**, **increase/decrease**, **maxima/minima**, **concavity**, **inflection**, **tangents**, **cusps**, **asymptotes**, **definite and indefinite integration**

Should we take for granted that these concepts, as presented, were organized in a clean, objective fashion?

Consider, for example, the discussion that accompanies sociological keywords: What is a *commodity*? What's *empirical*? What's *fashion*? Who's *family*? When are we being *pragmatic*? *aesthetic*? *natural*?

Today's recitation is motivated by two cultural studies, *Keywords* and *New Keywords*, (Figure 1) which set out to examine the history of words that are "familiar yet confusing".
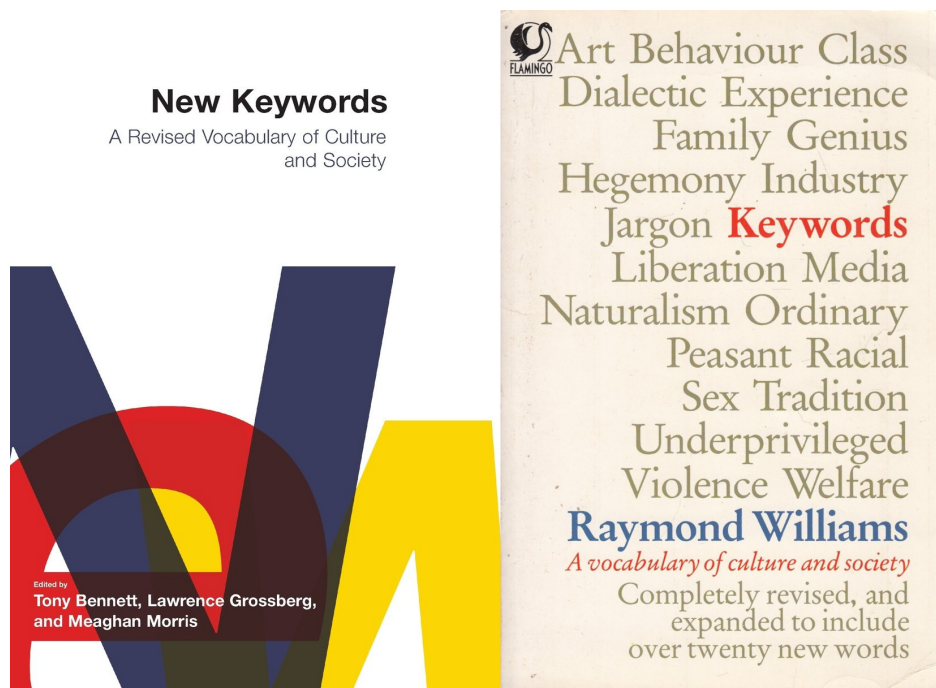

FIGURE 1. New Keywords (Bennett, Grossberg, Morris) and Keywords (Williams)

2. Creativity

Verbatim advice from Oliver Knill [1, Sec. 12]:

> As we are heading for our final, let us organize the knowledge accumulated so far. We can do that in various ways. One technique is a **mind map**. It allows on one picture to organize a vast amount of content and see connections which might otherwise be missed.

Exercise (in-class): Make a mind map of the most important facts which have appeared in the course so far. Do it on paper, a blackboard, whiteboard or using software. Refine it as much as possible. [1]

Exercise (at-home): (a) Write your own final exam! (b) take it! (c) grade it!

3. In historical context

Again, from Oliver Knill [2]:

> As one has distinguished the canons of **rhetorics**: memory, invention, delivery, style, and arrangement, or combined the **trivium**: grammar, logic and rhetorics, with the **quadrivium**: arithmetic, geometry, music, and astronomy, to obtain the seven liberal arts and sciences, one has tried to organize all mathematical activities.

Historically, one has distinguished *eight ancient roots of mathematics*. Each of these 8 activities in turn suggest a key area in mathematics. **counting and sorting** (arithmetic), **spacing and distancing** (geometry), **positioning and locating** (topology), **surveying and angulating** (trigonometry), **balancing and weighing** (statics), **moving and hitting** (dynamics), **guessing and judging** (probability), **collecting and ordering** (algorithms).

To morph these 8 roots to the 12 modern mathematical areas, we complement the ancient roots with calculus, numerics and computer science, merge trigonometry with geometry, separate arithmetic into number theory, algebra and arithmetic and turn statics into analysis.

modern root	mathematical area
counting and sorting	arithmetic
spacing and distancing	geometry
positioning and locating	topology
dividing and comparing	number theory
balancing and weighing	analysis
moving and hitting	dynamics
guessing and judging	probability
collecting and ordering	algorithms
slicing and stacking	calculus
operating and memorizing	computer science
optimizing and planning	numerics
manipulating and solving	algebra

References

[1] O. Knill, "Math 22a Handouts," Dec-2018 [Online]. Available: `http://www.math.harvard.edu/~knill/teaching/math22a2018/`. [Accessed: 09-Dec-2018]

[2] O. Knill, "Some Fundamental Theorems in Mathematics," Sep-2018.