Synthesizing Sources – the CYA strategy for ethical writing in the sciences

Why learn to synthesize sources? Because, in sciences, quoting is frowned upon. Using a direct quote brings undue attention to language when science would prefer we concentrate on ideas. One of the best guides to understanding ethical writing and avoiding plagiarism is Miguel Roiq’s *Avoiding plagiarism, self-plagiarism, and other questionable writing practices: A guide to ethical writing*. Currently, Dr. Roiq makes his work freely available as either an .html document or a word document that can be saved (if used for a class, please write and ask Dr. Roiq’s permission). In brief, Roiq points out a paradox in science writing that is notoriously difficult to address:

| Writers cannot plagiarize | thus | Writers must paraphrase | but | Technical language has no synonyms | and | Quoting is discouraged |

This writing conundrum is further complicated by his other suggestion which is to build expertise before you write...this is kind of difficult to do when writing is often required long before expertise is attained! Further, there is some good evidence that writing itself encourages the development of knowledge meaning that pedagogically (from a teaching standpoint), you will need to write in order to learn what it is you are writing about.

What is a writer to do? The answer is **SYNTHESIZE SOURCES**. When you discuss the literature on a topic, you have the responsibility to read more than a single source for your information. Gone are the days of *Wikipedia* and *Encyclopedia Britannica*. You must actively integrate your sources. Why? You stand a lesser chance of committing unintentional plagiarism if you use more than one main source for your work. If 4 people have basically said the same thing, then when you say it – and cite all 4 sources – you are “proving” the publication history behind the idea and the reader is more confident that you know what you are talking about. Multiple citations are most common when providing definitions, discussions, and explanations of a topic.

**MFAQs:**

- **What about “common knowledge”?**
  
  o Part I: For safety’s sake, nothing that you learned after the twelfth grade counts as common knowledge. If you are just beginning to study in your field, then EVERYTHING you read for the first time is new to you. Further, because you don’t have the expertise to judge whether something should be considered common knowledge in your field, you need to cite more rigorously than you will a few years from now. Keep in mind, though, that virtually every article even on a well-researched topic begins with a brief definition, even when the writer expects the readers to know what the subject is. This is part of the way that writers prove their credibility as well as mark the boundaries of their own intellectual allegiances.
  
  o Part II: Should you stay in research, you will find that you cite less as you gain expertise. In fact, by the time you get your PhD and move toward frequent publication, you are expected to cite “appropriately”: over-citing marks you as an amateur. But until you get your PhD and/or publish frequently enough to be widely considered an expert, you should cite abundantly.

- **“I feel like I’m citing every sentence!”**
  
  o Well, yeah, for the reasons stated above! This is particularly true of Introductions and Discussion sections in research reports, and all the parts of a Review Papers, except the conclusion. In a research report, the only original information is in the Research Question, possibly the Method, the Results, and some portion of the Discussion. In a Review paper, which
is by definition a critical synthesis of the research literature on a topic, the ONLY original contributions the author makes are 1) the critique and concluding recommendations; 2) the work of putting together all the sources; 3) the organization of information itself (a new or different perspective on a topic is one of the finest contributions a scientist can make).

**General Tips for Synthesizing Sources**


2) Mark similar information from each source in same manner (use the same color pen to highlight or underline; use a number system, etc.). So, mark all the information which is a definition in the same way, then all the examples, then the explanation, etc. If that is too complicated for the text, then mark information that you know is central and information that you are pretty sure is peripheral in different ways.

3) Make lists of information which is shared among sources
   a. List 1: summary of info that is in all sources (probably means this is CENTRAL information)
   b. List 2: summary of info that is in some sources (could be CENTRAL, could be PERIPHERAL)
   c. List 3: separate lists of info that is NOT shared among sources (probably PERIPHERAL -- meaning, specific to the source you are reading, but not necessarily to your research)

4) Write your explanation incorporating the information from Lists 1, 2, and 3 -- overall, it's best to start with the information shared by all the sources, and then incorporate less shared information. Peripheral information should be included last, if at all. If what you really need to provide the reader is a solid foundation for understanding the concept, then peripheral (idiosyncratic) information is confusing. On the other hand, if you are providing an in-depth discussion of something, then idiosyncratic information has a place in the writing.

**Using Citations Wisely: Put citations where they make the most sense**

Whichever documentation system you use, put each citation close to the information you wish to acknowledge. Do not automatically put cited material at the end of every sentence. For example, the following style...is ambiguous: “Pollination of Linaria vulgaris has been studied in both the field and the laboratory (Arnold, 1962; Howard, 1979).” Did Arnold do his studies in the field and Howard in the laboratory? Or Howard in the field and Arnold in the laboratory? Or both authors in both settings? Moving the first citation clarifies the situation: “Pollination of Linaria vulgaris has been studied in both the field (Arnold, 1962) and the laboratory (Howard, 1979).” (from McMillan, 2006, 149, Writing Papers in the Biological Sciences)

Single domain to multi-domain transition due to in-plane magnetic anisotropy in phase separated (La0.4Pr0.6)0.67Ca0.33MnO3 thin films
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(Dated: October 27, 2010) (as in Arxiv)
I. INTRODUCTION
The coupling between structure, transport, and magnetism in hole-doped manganites leads to phenomena such as, colossal magnetoresistance (CMR), colossal electroresistance (CER), photo-induced metal-insulator transition, and colossal piezoresistance (CPR)[1–5].

Science 15 April 1994; Vol. 264 no. 5157 pp. 413-415
DOI: 10.1126/science.264.5157.413

Thousandfold Change in Resistivity in Magnetoresistive La-Ca-Mn-O Films
A negative isotropic magnetoresistance effect more than three orders of magnitude larger than the typical giant magnetoresistance of some superlattice films has been observed in thin oxide films of perovskite-like La_{1-x}Pr_xCa_{0.73}MnO_y. Epitaxial films that are grown on LaAlO_3 substrates by laser ablation and suitably treated exhibit magnetoresistance values as high as 127,000 percent near 77 kelvin and ~1300 percent near room temperature. Such a phenomenon could be useful for various magnetic and electric device applications if the observed effects of material processing are optimized. Possible mechanisms for the observed effect are discussed.


Effect of strain and electric field on the electronic soft matter in manganite thin films
We have studied the effect of substrate-induced strain on the properties of thin films of the hole-doped manganite (La_{1-x}Pr_x)_{0.4}Ca_{0.33}MnO_y (x=0.4, 0.5, and 0.6) grown on NdGaO_3 (NGO) substrates, in order to distinguish between the roles played by long-range strain interactions and quenched atomic disorder in forming the micrometer-scale phase separated state. We show that a fluid phase separated (FPS) state is formed at intermediate temperatures similar to the strain-liquid state in bulk compounds, which can be converted to a metallic state by applying an external electric field. In contrast to bulk compounds, at low temperatures a strain stabilized ferromagnetic metallic (FMM) state is formed in the y=0.4 and 0.5 samples. However, in the y=0.6 sample a static phase separated (SPS) state is formed similar to the strain-glass phase in bulk compounds. Our results suggest that the substrate-induced strain is a function of temperature. Hence, we show that the temperature induced variation of the long-range strain interactions plays a dominant role in determining the properties of thin films of phase-separated manganites.


Photoinduced Insulator-to-Metal Transition in a Perovskite Manganese
Letters to Nature
Nature 388, 50-52 (3 July 1997) ; Received 27 November 1996; Accepted 21 May 1997
We have observed an insulator-to-metal (I-M) transition triggered by the photocarrier injection into the charge-ordered (CO) state of a perovskite manganese crystal, Pr_{0.5}Ca_{0.5}MnO_3. The photocurrent is a highly nonlinear function of applied electric field and of light intensity; both show a threshold behavior for the I-M transition. The dependence of the anomalous photocurrent on the excitation photon energy and the temperature excludes the laser heating as the cause of the effect, suggesting the photocarrier-mediated collapse of the CO state.

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Current switching of resistive states in magnetoresistive manganites
Magnetoresistive devices (based on, for example, magnetic multilayers)3 exhibit large changes in electrical resistance in response to a magnetic field, which has led to dramatic improvements in the data density and reading speed of magnetic recording systems. Manganese oxides having a perovskite structure (the so-called manganites) can exhibit a magnetoresistive response that is many orders of magnitude larger than that found for other materials, and there is therefore hope that these compounds might similarly be exploited for recording applications. Here we show that the switching of resistive states in the manganites can be achieved not only by a magnetic field, but also by an electric field. For manganites of the form Pr_,Ca,MnO_y, we find that an electrical current (and by implication a static electric field) triggers the collapse of the low-temperature, electrically insulating charge-ordered state to a metallic ferromagnetic state. We suggest that such a phenomenon could be exploited to pattern conducting ferromagnetic domains within an insulating antiferromagnetic matrix, and so provide a route for fabricating micrometre- or nanometre-scale electromagnets.

Journal of Physics: Condensed Matter Volume 21 Number 19 Create an alert RSS this journal

Colossal piezoresistance in phase separated manganites
We have measured the strain dependent transport properties of phase separated manganite thin films. We subjected (La_{1-x}Pr_x)_{0.4}Ca_{0.33}MnO_y thin films grown on NdGaO_3 (110) substrates to direct external mechanical stress using a three-point beam bending method. The resultant change in resistance reveals a colossal piezoresistance (CPR) in manganites. Our experiments reveal that phase separation is a necessary but not sufficient condition for CPR. The maximum CPR is observed only when the phase boundaries are free to move in the fluid-like phase separated state. Our results show that both long-range strain interactions and quenched disorder play an important role in micrometer scale phase separation in manganites, albeit in different temperature ranges.