



Organização: Pró-Reitoria de Pesquisa - USP



Workshop de Capacitação em Escrita Científica

Módulo 3

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Instituto de Física de São Carlos, USP*

USP, 2012



Workshop Outline

Módulo 1: O Gênero Literário

Seções de Um Artigo Científico

Módulo 2: Estrutura 1: *Abstract*

Módulo 3: Estrutura 2: *Introduction*

Módulo 4: Estrutura 3: *Results and Discussion, Conclusion*

Módulo 5: Estilo

Linguagem 1: Especificidade, Complexidade e Ambiguidade

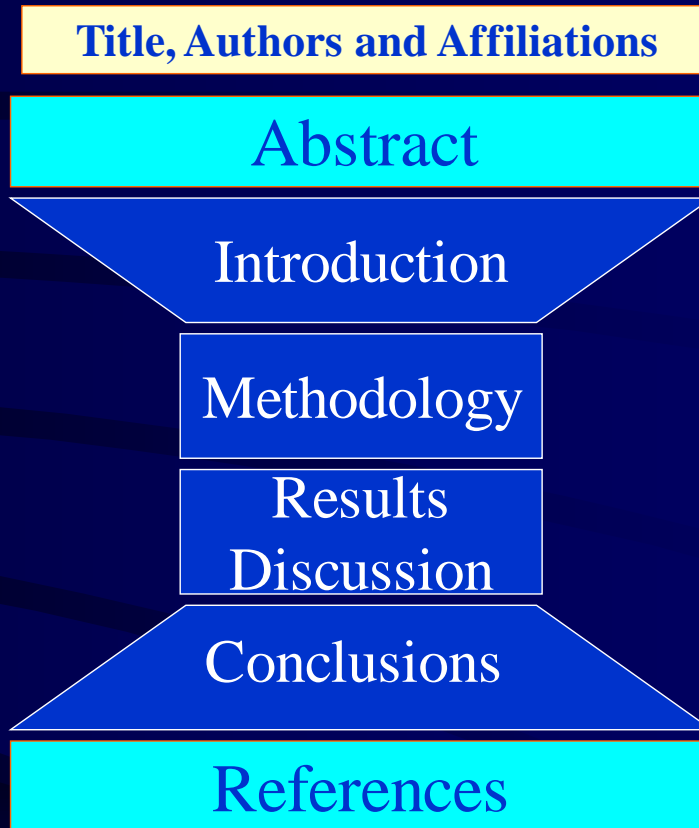
Módulo 6: Linguagem 2: Redundâncias, Ação no Verbo, Fluidez de Texto, Ritmo de Escrita

Módulo 7: Linguagem 3: *Plain English*, Escrever em Inglês, Preposições

Módulo 8: Linguagem 4: *Topic Sentences, Cover Letters, Final Remarks*

Módulo 3

Estrutura 2: Introduction

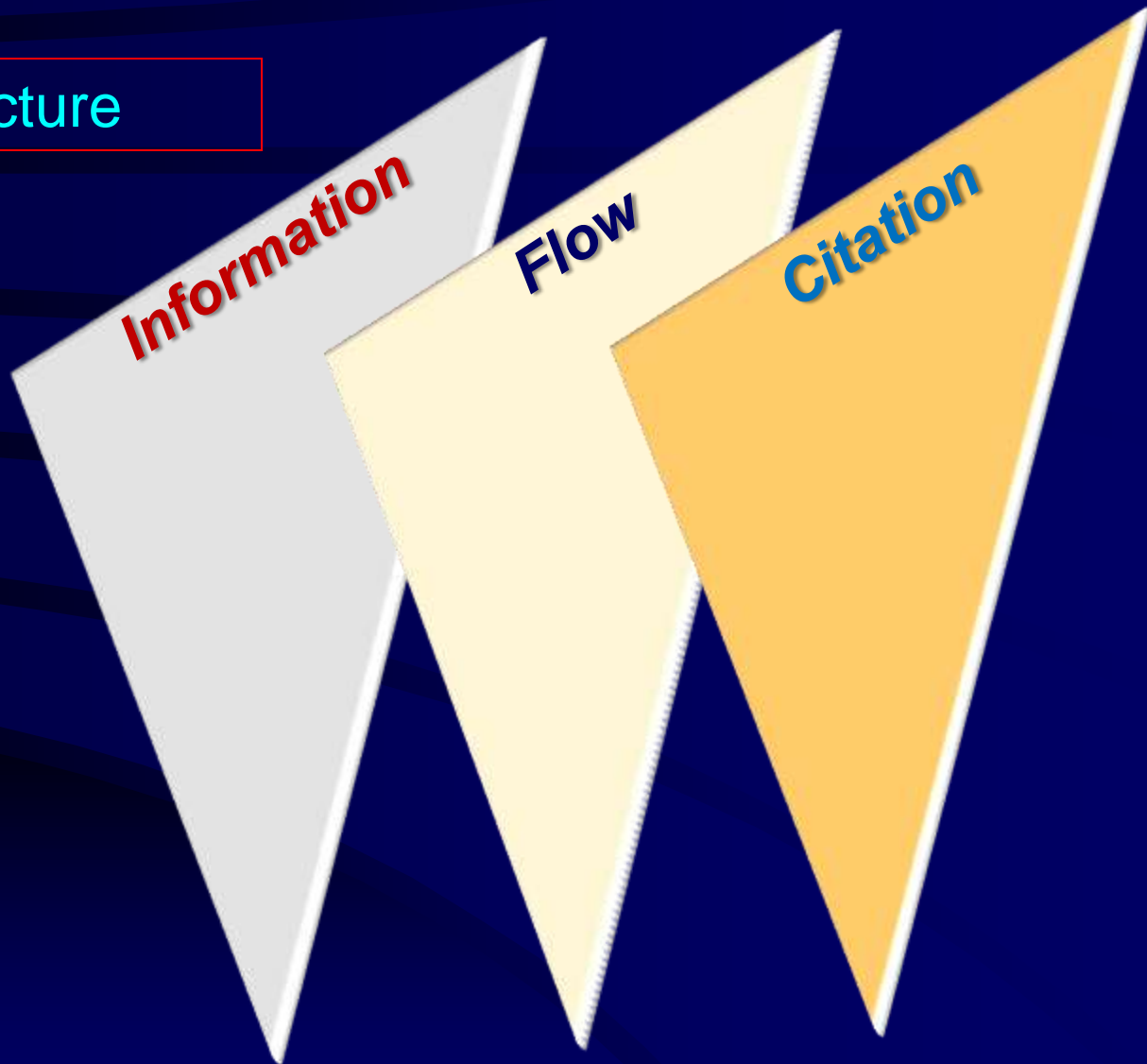


Adapted from: Hill et al., Teaching ESL students to read and write experimental papers, TESOL Quarterly, 16: 333, 1982:



Introduction

3-D Architecture





Introduction

1. Information



1. Contextualization

Present the research field and show the importance of the main area,
Make terms and processes familiar.

M3P1 Lang

“The ability to pattern mammalian cells in specific areas on a surface has become a very important topic of research because of its applications in tissue engineering, cell arrays, and biosensors. [...]. Early work to confine cells to micron-size areas was performed by Carter, where fibroblasts were patterned on islands of alladium [1]. Later, the Whitesides group utilized self-assembled monolayers (SAMs) to present microcontact printed adhesive islands against an inert ethylene glycol (EG) background to geometrically control cell adhesion.[2]”

Rubner et al., *Langmuir* **2004**, 20, 1362.



1. Contextualization

Present the research field and show the importance of the main area,
Make terms and processes familiar.

M3P8 Anal Chem

“Concentration determination of analytes such as biomarker molecules and drug substances and their related compounds in biological matrixes, termed as “bioanalysis”, is a critical part of drug discovery and development. Although ligand-binding assays are still the main platform for the bioanalysis of protein and peptide analytes, liquid chromatography mass spectrometry (LC MS) assays play increasingly more important roles as a complementary platform.

Juan et al., Analytical Chem, In Press



1. Contextualization

Present the research field and show the importance of the main area,
Make terms and processes familiar.

M3P10 Int J Inf

Web usage mining is a discipline within the field of web mining that concentrates on developing data mining techniques to model and study user web navigation behavior.^{1,2} In the context of web site personalization, web usage mining techniques have been utilized to take advantage of the data collected from users' interactions with a web site to study users' navigation behavior. Understanding user behavior **is invaluable in order to** deliver tailored content to the user,³ to support the creation of web agents aimed at guiding users within web site,⁴ or to improve the strategic requirements analysis for web sites.⁵

Borges et al., International Journal of Information Technology & Decision Making, 9, 2010, 547.



2. State the Gap

Open Questions, Restrictions and Limitations

M3P2 IEEE Sig Proc

“To make these applications viable with possibly vast numbers of sensors, **device costs will need to be low** (from a few dollars to a few cents depending on the application), sensors will need to last for years or even decades without battery replacement, and the network will need to organize without significant human moderation. **Traditional localization techniques are not well suited for these requirements.** Including a global positioning system (GPS) receiver on each device **is cost and energy prohibitive** for many applications, **not sufficiently robust** to jamming for military applications, and **limited to outdoor applications.** Local positioning systems (LPS) [6] rely on high-capability base stations being deployed in each coverage area, **an expensive burden for most low-configuration** wireless sensor networks.

Patwari N. et al, IEEE Signal Processing Magazine, 2005, p 54

2. State the Gap

Open Questions, Restrictions and Limitations

M3P9 JACS

“Molecular oxygen is an ideal oxidant, and significant progress has been made in the development of catalytic methods for aerobic alcohol oxidation.⁹ Nevertheless, key challenges must be addressed in order for such reactions to find widespread use in the synthesis of complex molecules. Large-scale applications of aerobic alcohol oxidation are constrained by safety concerns associated with the combination of O₂ and organic solvents and reagents,^{8a,b} as well as the frequent use of halogenated solvents.

Hoover et al., J. Am. Chem. Soc. 133, 16901, 2011

2. State the Gap

Open Questions, Restrictions and Limitations

M3P8 Anal Chem

“One common drawback of the full scan MS approach is the lower selectivity caused by higher background or interferences as compared to that seen in the SRM approach. Recently, there have been significant advances in the capabilities of high-resolution mass spectrometry (HR-MS) instrumentation [11,12]. HR-MS can provide additional advantages in resolving each isotopic ion from the background so that higher selectivity can be achieved.

Juan et al., Analytical Chem, In Press



2. State the Gap

Open Questions, Restrictions and Limitations

M3P11 SIAM J Comput

The complexity of terrain guarding **has been an open problem of interest since 1995**, when an NP-completeness proof was proposed but never completed by Chen, Estivill-Castro, and Urrutia [2]. They described vertex and clause gadgets and suggested that they could be put together along the lines of Lee and Lin's reduction for guarding polygons [13].

King et al., SIAM J. Comput. 40, 1316, 2011

3. Show the State-of-the-Art Evidencing recent research and findings

M3P8 Anal Chem

“One common drawback of the full scan MS approach is the lower selectivity caused by higher background or interferences as compared to that seen in the SRM approach. **Recently, there have been significant advances** in the capabilities of high-resolution mass spectrometry (HR-MS) instrumentation [11,12]. HR-MS can provide additional advantages in resolving each isotopic ion from the background so that higher selectivity can be achieved.

Juan et al., Analytical Chem, In Press



3. Show the State-of-the-Art Evidencing recent research and findings

M3P3 Int J Plast

“Recently, there have been developed many advanced approaches to describe plastic anisotropy. The strain rate potential is another concept that can describe plastic anisotropy (Barlat et al., 1993; Yoon et al., 1995; Chung et al., 1996; Kim et al., 2008a,b; Rabahallah et al., 2009; Van Houtte et al., 2009; Cazacu et al., 2010). **Non-associated flow plasticity was also implemented** to the finite element method to predict plastic anisotropy (Civitanic et al., 2008; Taherizadeh et al., 2009). Experimentally it was shown that the yield surface shape can evolve in complex ways (Kuroda and Tvergaard, 2001; Kuwabara, 2007). **For the corresponding modeling, it has been acknowledged that** more advanced models should capture the distortion of the yield surface (Wu et al., 2005; Holmedal et al., 2008; Aretz, 2008; Korkolis and Kyriakides, 2008; Stoughton and Yoon, 2009). **Yield criteria** to describe plastic anisotropy for complex hcp materials **were proposed** by Cazacu et al. (2006) and Plunkett et al. (2008). Anisotropic hardening behaviors for the hcp materials were also investigated (Plunkett et al., 2007; Nixon et al., 2009). [...]. **Recently, an analytical approach** considering the r-value directionality as a main contributor to the earing profile **was derived** by Yoon et al. (2006). The method provides a simple tool for the prediction of the earing profile using, as input, basic information including the r-value directionality, the initial blank size and the cup radius.

Yoon et al., International Journal of Plasticity 27 (2011) 1165



4. State the importance of your study Evidencing Implications and/or Applications

M3P4 Nano Lett

“ [...] This is a simple way to produce fundamentally and practically interesting multilayer structures with unique mechanical properties and precise control over film composition and thickness. More importantly, this technique offers a possibility of multifunctional composites in which the strength will be only one of the factors determining its applications. Additionally, deposition of nanotubes in the form of individual layers opens the way to oriented nanocomposites,[43] taking advantage of the sheer force as in spun fibers [44,45,47] or magnetic fields.[46]”

Olek et al., *Nano Lett.*, Vol. 4, 1889, (2004)



4. State the importance of your study Evidencing Implications and/or Applications

M3P12 IEEE T.E.C.

“The proposed memetic algorithm that combines search by an ES [44] on the upper level and nonlinear local optimizations to handle complex nonlinear equality constraints and to realize a Lamarckian learning **principle is a promising concept** for general design optimization problems in which a large number of nonlinear model equations and constraints as well as discrete design decisions and possibly discontinuous value functions are present, well beyond the domain of chemical engineering.”

Urselmann, et al., IEEE Transactions on Evolutionary Computation, 15, 2011, 659

5. State the purpose of the paper

M3P5 Lang

“In this paper, detailed characteristics of the hydrated (LPEI/PAA)OEGDA composite are investigated and the reason for its relatively high ionic conductivity is discussed. Morphological effects due to the presence of OEGDA oligomer on the phase transition will also be described.”

Lowman et al., *Langmuir* **2004**, 20, 9791-9795

M3P6 Lang

“**In the work reported here**, a polyelectrolyte multilayer platform capped by a polyanionic surface was created through layer-by-layer assembly [21] and stamped with a polycationic pattern using POPS, to form docking sites for the negatively charged magnetic beads.”

Lyles et al., *Langmuir* **2004**, 20, 3028-3031



5. State the purpose of the paper

M3P9 JACS

Here, we report a new, highly active (bpy)CuI/TEMPO catalyst system that effects selective aerobic oxidation of a broad range of primary alcohols, including allylic, benzylic, and aliphatic derivatives, to the corresponding aldehydes. The reactions proceed in high yield, exhibit broad functional-group compatibility, and achieve chemoselective formation of aldehydes with negligible overoxidation to the carboxylic acids. Furthermore, the reactions exhibit exquisite selectivity for 1 over 2 alcohols, enabling selective oxidation of diols, without requiring the use of protecting groups. The use of a traditional organic solvent (acetonitrile), and the ability to carry out most of the reactions at room temperature with ambient air as the oxidant greatly enhances the practicality of these methods. Overall, the utility of these methods rivals or surpasses that of traditional laboratory-scale alcohol oxidation reactions. The development, scope, and limitations of these methods are elaborated below.

Hoover et al., J. Am. Chem. Soc. 133, 16901, 2011



5. State the purpose of the paper

M3P13 Human Comp Int

In this article, we explore the ways in which cognitive personalization technologies can support effective sensemaking with web-based educational resources. First, we describe several use cases to illustrate how learners in a variety of settings might interact with and benefit from cognitive personalization tools. We then discuss a theoretical model of educative sensemaking. **Next, we describe** a prototype cognitive personalization service, the Customized Learning Service for Concept Knowledge: CLICK. Its personalization capabilities are realized through a combination of natural language processing algorithms and graph analytic techniques. We use the term “service” as CLICK has been designed and implemented as a web service application programming interface, enabling cognitive personalization capabilities to be flexibly embedded in a rich variety of tools, portals, and learning environments. **We then describe** a learning environment implemented with CLICK and discuss empirical findings from a controlled, mixed-method study that explored its impact on learners’ sensemaking processes. **Finally, we discuss** implications of our work and future challenges for promoting personalized sensemaking with digital educational resources.

Butcher et al., Human–Computer Interaction, 26, 2011,123.

Usually for Computer Science-related areas

Introduction may be followed by additional Sections on:

- Problem Formulation
- Related Work
- Case Studies
- Relevant, Specific Topics

1. Contextualization

Present the research field and show the importance of the main area

2. State the Gap

Open Questions, Restrictions and Limitations

3. Show the State-of-the-Art

Evidencing recent research and findings

4. State the importance of your study

Evidencing Implications and/or Applications

5. State the purpose of the paper



Introduction

2. Flow

Structure

Information in the text flows from General to Specific, arriving at purpose.



Introduction

General

Contextualization

Your Field

Sumarizing Previous
Research

Purpose

Specific

Your work



“Afunilando” o fluxo de idéias....

M3P7 Nano Lett

While a vast majority of LBL systems undergo linear growth (l-LBL), there are also some quite special combinations of polyelectrolytes which exhibit so-called “exponential growth” (e-LBL). **Recently, a different modification** of the technique which does not require rinsing and is based on dewetting phenomena, so-called dewetting LBL or d-LBL, **was also introduced** by our group.⁴⁴ The l-LBL method has been studied and applied most extensively and thus covers most of LBL publications. **A substantially smaller and more recent subset of LBL literature is related** to e-LBL films. Historically, e-LBL was observed for the first time in 1999 by Elbert et al.⁴⁵ for poly(L-lysine) (PLL) and alginate (AG) polyelectrolytes pair. The authors observed.....

Podsiadlo et al., Nano Letters, 2008 , 8, 1762



3. Citation



The citation process:

Authors cite to indicate where the ideas came from

Authors **DO NOT** cite to show where the text came from!!!

Selecting references to cite

Seminal Papers

Contextualization / Gap

Most Recent Papers

State of the Art / Gap

Most Important Papers

Relevance / Motivation / Importance

Style

- Contextualization and Gap: Past, present-perfect (continuous) generally used.
- Purpose: Present or past tense are preferable.
- Use the active voice as much as possible.
- Third Person with some use of first person.



John M. Swales, Genre Analysis: English in Academics and Research Settings, Cambridge University Press, 1990.

Patwari N. et al, IEEE Signal Processing Magazine, 2005, p 54

Rubner et al., *Langmuir* **2004**, 20, 1362.

Lowman et al., *Langmuir* 2004, 20, 9791-9795

Borges et al., International Journal of Information Technology & Decision Making, 9, 2010, 547.

Urselmann, et al., IEEE Transactions on Evolutionary Computation, 15, 2011, 659

Olek et al., *Nano Lett.*, Vol. 4, 1889, (2004)

Yoon et al., International Journal of Plasticity 27 (2011) 1165

Podsiadlo et al., Nano Letters, 2008 , 8, 1762

Butcher et al., Human–Computer Interaction, 26, 2011,123.

King et al., SIAM J. Comput. 40, 1316, 2011



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Organização: Pró-Reitoria de Pesquisa - USP



Workshop de Capacitação em Escrita Científica

Módulo 4

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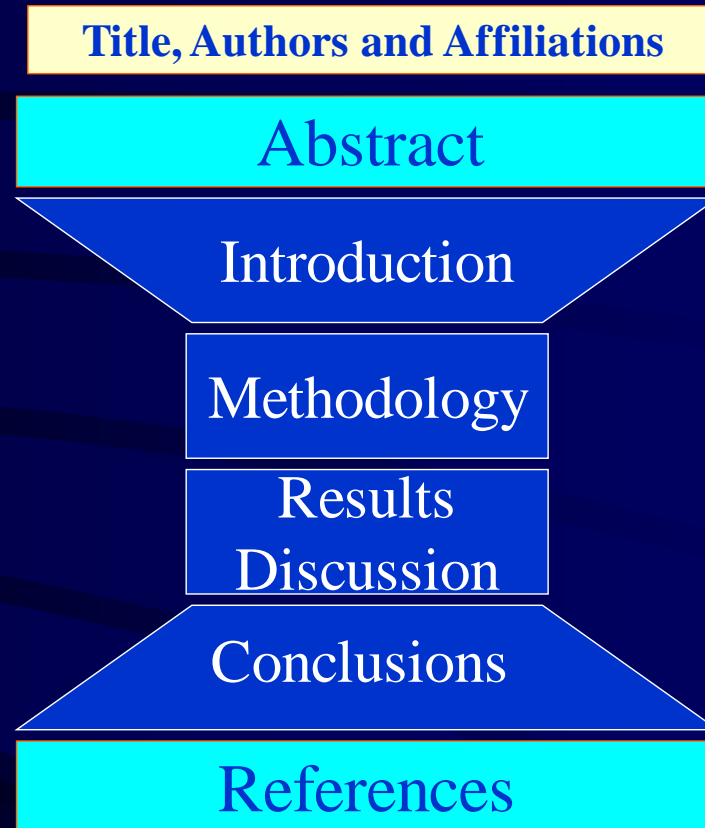
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Módulo 8: Linguagem 4: *Topic Sentences, Cover Letters, Final Remarks*

Módulo 4

Estrutura 3:

Results and Discussion, Conclusion



Adapted from: Hill et al., Teaching ESL students to read and write experimental papers, TESOL Quarterly, 16: 333, 1982:

Results and Discussion

Results – Discussion – Conclusion

Results – Discussion

Results and Discussion – Conclusion

Results – Discussion and Conclusion

Source: Science Research Writing for Non-Native Speakers of English, Hilary Glasman-Deal, Imperial College Press, 2009



Results and Discussion

The most important section of a paper

The section where you prove your initial question, hypothesis, idea, etc.

Illustrative Materials (figures, tables, graphs, images), Outcome of Calculations, and **TEXT**.

Importance of figure Quality, Data Analyses and Statistics

The way you write your achievements makes the whole difference

An Interesting Example...

M4P1 Nature

“It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material”

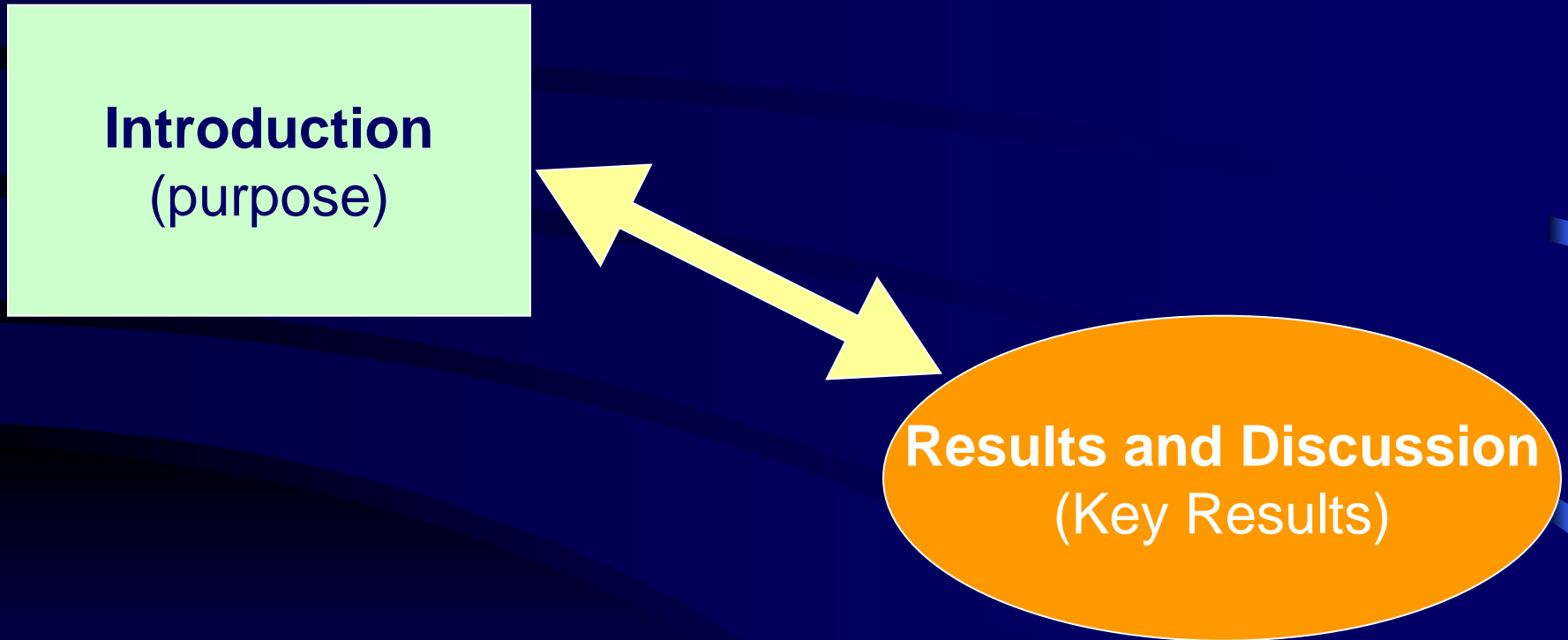
Watson, JD, Crick, FHC, *Nature*, 171, 737, 1953.



Remember !!!!!

You (and maybe your advisor) know every detail about your investigation.

Readers know **nothing** about your work (yet).



Model/Structure for Results and Discussion

??????????

A Tentative Model:

- Background / Importance

- Describe the outcomes of your research
(figure, tables, graph, image, calculations, algorithm tests, etc)

* In computer Science-related areas this section is usually divided in a number of specific subtopics .

- Interpretation

- Comparison

Example 1

M4P2 Nano Lett

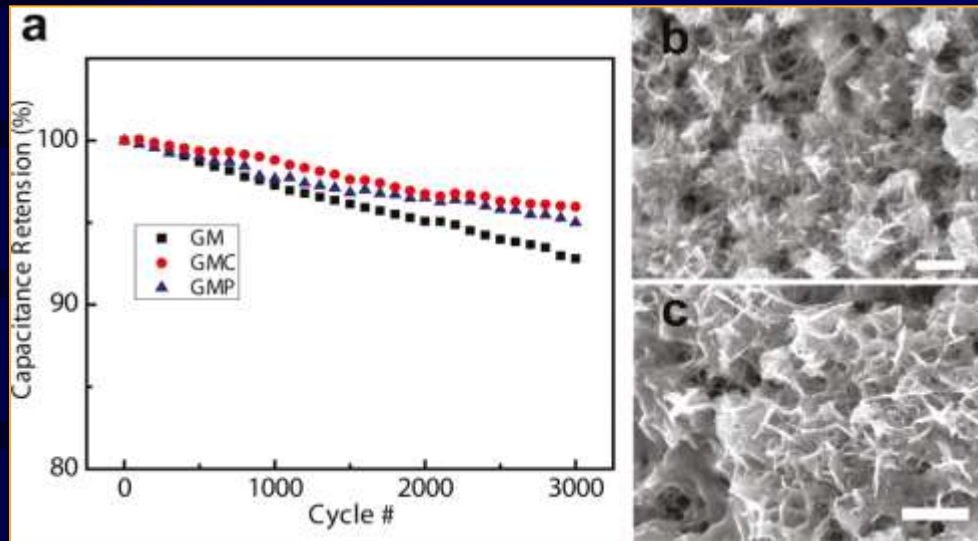


Figure 4. Cycling performance of hybrid nanostructured electrodes. (a) Comparison of cycling performance for three hybrid systems showing capacitance retention of ~93%, ~96%, and ~95% after 3000 cycles of charging and discharging at current density of 1 mA/cm² for GM, GMC, and GMP, respectively. (b, c) SEM images of GMC- and GMP-based textiles after 3000 cycles showing that the MnO₂ nanoflowers were still wrapped with conductive layers and the whole structural integrity of active electrode materials was well maintained. Scale bars: 1 μm.

Yu et al., Nano Lett. 2011, 11,
4438

Example 1

M4P2 Nano Lett

- Cycling performance is another key factor in determining the supercapacitor electrodes for many practical applications. Excellent cycling stability is crucial for real supercapacitor operations. The cycling tests for all three different electrode systems were carried out using the same current density of 1 mA/cm². Figure 4a compares the cycling stability of three systems and shows that ~93%, ~96%, and ~95% capacitance was retained over 3000 cycles of charging and discharging for GM-, GMC-, and GMP-based electrodes, respectively. All three electrode systems demonstrate much better cycling performance compared to those reported in previous work (typically 75-85% retention over 1000 cycles),^{13,21,22} thanks to hierarchical structures of graphene/MnO₂ textiles.

Yu et al., Nano Lett. 2011, 11, 4438

Example 3

M4P6 JACS

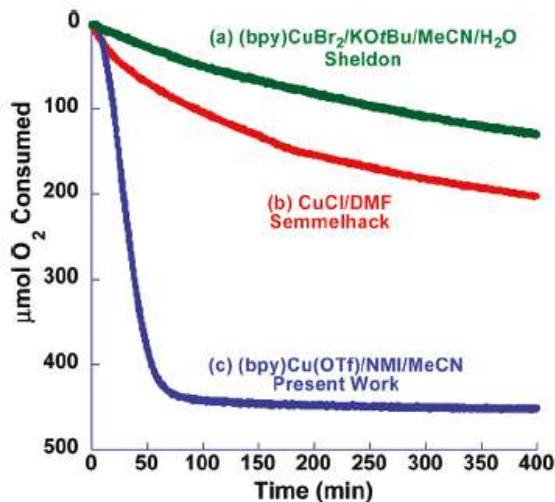


Figure 1. Comparison of three different Cu/TEMPO catalyst systems in the aerobic oxidation of 1-octanol (1.0 mmol) at 27 °C. Catalyst systems include the following: (a) “Sheldon conditions”²⁴ (similar to Table 1, entry 2): CuBr₂ (5 mol %), bpy (5 mol %), TEMPO (5 mol %), and KOtBu (5 mol %) in 2:1 MeCN:H₂O (0.67 M) (green); (b) “Semmelhack conditions”^{18a} (similar to Table 1, entry 1): CuCl (10 mol %) and TEMPO (10 mol %) in DMF (0.4 M) (red); and (c) Cu(OTf) (5 mol %), bpy (5 mol %), TEMPO (5 mol %), and NMI (10 mol %) in MeCN (0.2 M) (blue). See the SI for additional details.

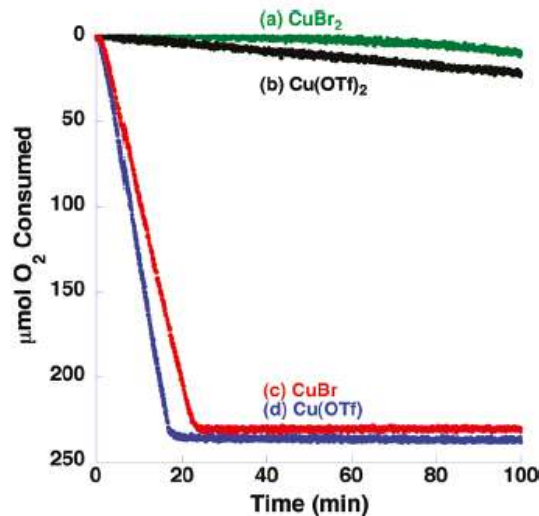


Figure 2. Effect of Cu source on the rate of aerobic oxidation of benzyl alcohol (0.5 mmol) at 27 °C. The Cu source (5 mol %) was combined with TEMPO (5 mol %), NMI (10 mol %), and bpy (5 mol %) with [Cu] = (a) CuBr₂ (green), (b) Cu(OTf)₂ (black), and (c) CuBr (red), and (d) Cu(OTf) (blue). Reactions employing CuBr₂ consistently exhibit a long induction period. See the SI for additional details.

Hoover et al., J. Am. Chem. Soc. 133, 16901, 2011

Example 3

M4P6 JACS

- As shown in the time course plot, the new catalyst system enables complete conversion of this aliphatic alcohol within approximately 1 h at room temperature. A 10-15 min induction period is observed at the start of the reaction, the mechanistic origin of which is currently under investigation. Sheldon and Koskinen have noted the beneficial effect of noncoordinating anions with CuI-based catalyst systems;^{24b,25c} however, we observe that the initial oxidation state of the copper catalyst has the most significant impact on the reaction efficiency (Figure 2). Cu I salts exhibit much higher reactivity than Cu II salts. It is reasonable to expect that Cu cycles between +1 and +2 oxidation states during the catalytic mechanism, so the origin of the dramatic difference in rates using CuI vs CuII precursors is not clear. Ongoing mechanistic studies are focused on elucidating the origin of this unusual effect.

Hoover et al., J. Am. Chem. Soc. 133, 16901, 2011



Style

- Past tense;
- Third Person, preferably;
- Use active voice whenever possible.

- Subheadings may improve organization and comprehension

The right place for captions

Tables: above, left justified.

Figures: below, left justified

Always consult the Journal's Guide for Authors

Reach a balance between description of data in the text and in the figure/table legend

Any reader must **understand** a Figure/Table without reading the results section.



Tips

Do you really need a figure?

“ The thickness of the film was estimated at 10 nm per bilayer, using AFM....”

“Seed production was higher for plants in the full-sun treatment (52.3 +/-6.8 seeds) than for those receiving filtered light (14.7+/- 3.2 seeds)....”

Note: Always use a space between the value and the unit:

“The estimated length was 10 m”, or, “the optimum time was 100 min.”

Conclusions

Function: To state the importance of the paper to the development of the field.

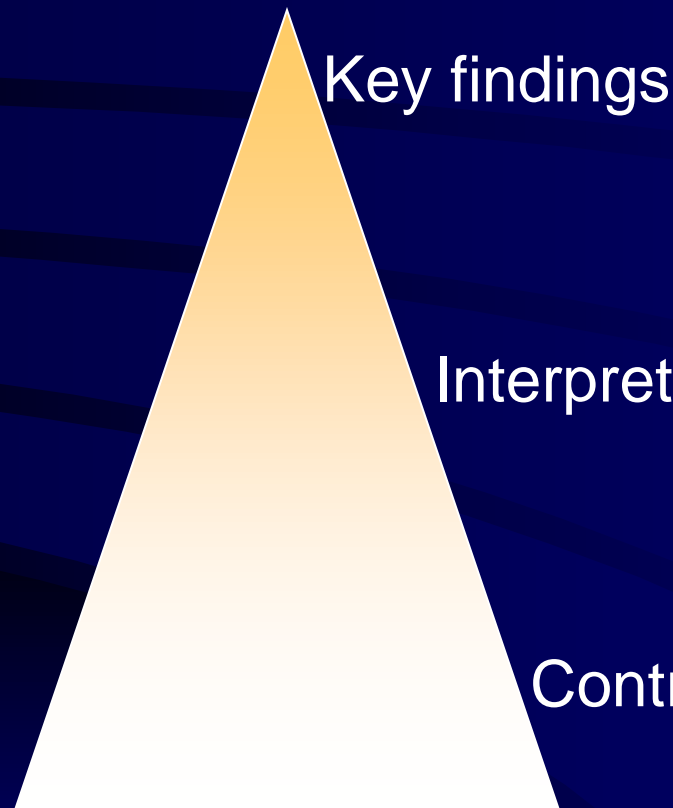
Ideas flowing from **Specific** to **General**.

Pyramidal Structure

Specific



General



A Suggested Model

1. State main findings

Emphasize your main results.

2. Interpretation of the main findings

Take a few sentences to re-state the interpretation of the key results.

3. Contributions/Progress to the field

Describe the implications of your achievements to the field.

4. Further Work (optional)

Be careful: To much future work may suggest that your paper is not complete

Style

- Past and Present tense;
- Third Person, preferably;

Categorize the sentences in the following conclusions sections:



Example 1

M4P1 Nano Lett

In summary, by 3D conductive wrapping of graphene/MnO₂ nanostructured electrodes with CNTs or conducting polymer, we can optimize the electrochemical utilization of highly insulating MnO₂ materials and greatly enhance their supercapacitor performance. The rationally designed composite electrodes exhibit high specific capacitance, excellent rate capability, and exceptional cycling stability. Such a 3D conductive wrapping approach represents an effective and convenient technique to improve the specific capacitance and rate capability of oxidebased supercapacitors and can be applicable to a wide range of insulating energy storage electrode materials such as sulfur, LiMnPO₄, and silicon in lithium-ion batteries. For example, conductive polymer can be used for wrapping sulfur cathode materials to enhance electrode conductivity and contain polysulfide intermediates, therefore minimizing polysulfide dissolution and improving the performance of LiS batteries.

Yu et al., Nano Lett. 2011, 11, 4438



Example 2

M4P4 Mechatronics

For the purpose of increasing generated power in harvesting energy, according to Eq. (14) that has been derived in this paper, the elastic base can indeed lower the resonant frequency of the miniature generator to approach ambient vibration frequency. The resonant frequency reduction percentage depends on mass and stiffness of the proposed elastic base. Based on Eq. (14) and Table 1, the resonant frequency reduction percentage can reach 70% when $r = 1$ and $a = 10$. If the miniature generator is attached to the rigid base, the maximum power is 1.08 nW. By contrast, if the miniature generator is attached to an elastic base with a point mass, the maximum value of the power 0.92 μ W is obtained with the mass ratio $a = 10$ and stiffness ratio $r = 6$. The power of different cases on elastic base with point mass is shown in Table 4. In this study, the arm swing frequency is designated as 15 Hz, and the theoretical resonant frequency of the miniature generator of piezoelectric bender shown in Eq. (22) is about 81.2 Hz. According to Table 1, when the stiffness ratio r is fixed if the mass ratio a increases, the resonant frequency decreases and is close to 15 Hz, the arm swing frequency. Therefore, the bender vibration amplitude becomes larger. The more the bender deforms, the more.....

W. Li et al., Mechatronics 21 (2011) 1183



Example 3

In this study, we demonstrated cancer immunotherapy using DCs pulsed with multifunctional core–shell nanoparticles consisting of a superparamagnetic Fe₃O₄ core covered with a photonic ZnO shell. The nanoparticles provided simple and consistent outcomes for the ex vivo antigen loading of DCs, for in vivo tracking and induction of strong anti-CEA immune responses, even in an immune-tolerant host. The ability of the nanoparticles to be efficiently loaded into DCs in a short incubation period (1 h) without surface modifications or transfection agents may expedite clinical trials. It might be possible to bypass the complex chemical modifications of the Fe₃O₄ surface that are generally performed in an organic environment to conjugate tumour antigens, a step that has the potential to alter their antigenicity. When combined with a tumour-associated antigen, nanoparticle- loaded DCs did not show changes in viability and phenotype. Taken together, the core–shell nanoparticle could be applied in diverse DC-based immunotherapies that need to monitor antigen loading in vitro and track DCs in vivo to ensure consistent clinical efficacy.

Cho et al., Nature Nanotechnology, 6, 2011, 675



Example 4

M4P7 ACS Nano

The nanospheres used **in the present study** represent a novel combination of features including direct visualization by electron and fluorescence microscopy, as well as the ability to examine compartmentalization after endocytosis by relaxometry. The magnetic properties also enabled removal of excess PEI, enabling examination of PEI-mediated endocytosis without the confounder of toxicity of free PEI. **Endocytosis involved a clear sequence of events: interaction of nanoparticles with the cell membrane induced membrane ruffling and tubular invagination, characteristic respectively of unregulated/unselective macropinocytosis and clathrin- and caveolin-independent endocytosis, followed by time-dependent intracellular clustering within lamellar envelopes.** The nanosphere architecture **thus** offers a broad scope for delivery of a wide range of agents to intracellular compartments. The **findings we have presented** will assist in the design and synthesis of next generation nanoparticles for site-specific drug delivery.

Evans et al., ACS Nano, In Press



Example 5

For novice learners, educative sensemaking is a daunting task. Students must identify relevant information, analyze its relevance to the task at hand, make connections with prior knowledge, diagnose the adequacy and accuracy of their current representations, integrate new information into their current representations, and reanalyze emerging representations. The results presented here demonstrate consistent, positive impact of personalization on students' metacognitive processes, the depth of their sensemaking behaviors, and the integration of new and prior knowledge. Although our results were gathered using a prototype instantiation of the CLICK service, there are a wide variety of tasks that could be supported by CLICK's personalization technologies. Our work advances the capabilities of sensemaking tools and stimulates future potential research by providing a flexible set of cognitive personalization algorithms that can be embedded in a wide variety of learning technologies for a large range of educational tasks. Future technologies could support the use cases we have gathered from educators (e.g., concept map development and presentation building), or could embed the algorithms into new tasks such as developing scientific experiments (e.g., collecting and analyzing relevant prior findings) or analyzing visual representations. As we move forward, we are especially interested in studying how we can support multimedia forms of student sensemaking. We see great potential in increasing the richness of students' instantiated representations, for example, by using a combination of visual, audio, and textual information. By not tying our algorithms to a stand-alone prototype, we hope to facilitate the development of new sensemaking tools and to set the stage for future technologies that will push the envelope of educative sensemaking support and discover robust solutions to the sensemaking paradox in self-directed learning.

Butcher et al., Human-Computer Interaction, 26, 2011,123.



Example 6

Conclusions

In this work, we tackle the problem of predicting the next web page request of users' when navigating the web. Most previous research in the field has exclusively made use of the Hit and Miss score (HM) for evaluating prediction accuracy. We argue that the HM score has limitations in terms of evaluating the accuracy and therefore complementary scoring methods are necessary.

To alleviate this problem we have investigated three additional useful scoring metrics: the Mean Absolute Error (MAE), the Ignorance Score (IS) and the Brier Score (BS). As we have discussed the scoring metrics have different interpretations [...]

This work makes use of the VLMC model as our prediction mechanism, however, we believe the study can be generalized to other prediction mechanisms that provides a set of predictions ranked by their probabilities. One such example is the use of hybrid Markov models that assemble models of various orders.⁴⁷ Such models could benefit [...]

Our experiments show that the additional scores and the concept of unexpected events provide valuable insight when setting up a model for predicting the next link choice of a user based on other users navigation preferences. The detection of unexpected events can also provide the means to assess the adequacy of recommendations that are provided based on historical data. [...] In addition, the experimental results confirm that the prediction accuracy increases with the order of the model, and also increases when unexpected events (or unpredictable), controlled by a parameter, α , are being detected rather than being predicted. The experiments also show that the accuracy of prediction varies for different data sets.

Future work involves a better understanding of what makes a prediction algorithm such as maximum likelihood perform better on different data sets. A preliminary investigation taking into account *concept drift*⁴⁵ when building the variable length Markov model over a long period was conducted and the results reported in Ref. 50. Finally, we also wish to apply the prediction algorithm to data sets from different applications areas such as patrolling the web.

Borges et al., International Journal of Information Technology & Decision Making, 9, 2010, 547.

“Conclusion and Outlook”

[.....] *

In future work, initialization procedures based on statistically-rigorous methods such as latin hypercube design or orthogonal arrays **will be** implemented within the memetic algorithm introduced in this contribution. The MA **will be** applied to an extended model of the reactive distillation column with an optional external side reactor and also to different design optimization problems from the domain of chemical engineering to further test the potential and the limitations of the proposed solution approach. **This** will also provide additional insight into the performance of the different mechanisms for mutation and recombination used in the MA.

Urselmann, et al., IEEE Transactions on Evolutionary Computation, 15, 2011, 659



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