

Lexical Bundles for Establishing Novelty

Researchers use four moves to show how their work is important, relevant, and novel:

(1) Explain the **significance** of the research area, (2) Describe the **status quo** (current state of research) in the field, (3) Identify a “**gap**” in that research, and (4) **Fill** that gap with your project.

This handout offers examples to highlight possible lexical bundles used to complete each move.

Move 1: Explaining the Significance

Here, you should explain why someone would care about this research. Your audience for this move should be broader than your primary target audience. If possible, it should be apparent why the general public would care.

Common phrases for explaining the significance include:

- X project is important because...
- This work investigates modern concerns with...
- X significantly impacts...
- Due to an ever-increasing number of...
- To understand X, it is crucial to...
- X is especially useful in...
- X has become an urgent issue in...

Example 1

In many **modern** radar applications, pulse compression is **a key element** to achieve the required performance. [...] In turn, beam-forming is **another well-known** signal processing technique used in sensor arrays for directional signal transmission or reception. [1]

Example 2

There is **growing pressure** to support more and more communications within those spectrum bands that are most conducive to operating a cost-effective wireless system. [2]

Example 3

Clock synchronization is an **important** service for wireless sensor networks. [3]

Move 2: Describing the Status Quo

After explaining the significance of the topic in general, researchers should describe current practices that are being used by researchers within the defined/limited scope of your field (e.g., reviewing current research practices, literature, or state of affairs).

Common phrases for describing the status quo include:

- Prior research has shown that...
- The most-used method for investigating this problem is...
- Previous studies have evaluated...
- X process has been described as...
- Recent work in X has questioned whether...
- Ongoing studies indicate that...
- New models of X suggest that...

Example 1

Many engineers have noted that if one were able to form truly simultaneous transmit beams in independent directions, then a flexible radar system could be built that would be capable of true simultaneous multifunction operation. [...] **Until recently**, radar transmitters have not enjoyed the same degree of software-driven agility as radar receivers. **Nowadays** radar transmitters incorporate highly agile, software-driven waveform generators. [1]

Example 2

Many people assume that the only way to meet this need is to find an unused block of spectrum, sometimes called white space, and make that block of spectrum available for use, where a block includes all the spectrum within a given frequency range and a given geographic area. [2]

Example 3

Multiple existing MAC protocols use clock synchronization to save energy through coordination of wakeup times with neighbors. **Other applications** require clock synchronization for ordering sensed events or to coordinate actuators. **Currently, synchronization mechanisms** consume a significant amount of energy due to the periodic exchange of messages used to adjust local clocks. [3]

Move 3: Identifying a “Gap”

In this move, researchers must show that the current practices or state of research (i.e. “status quo”) in the field are incomplete, unsatisfactory or inconclusive, and demonstrate a need for this gap to be filled.

Remember, while the common phrases below indicate *that* the current practices are incomplete, the content that follows the ellipses (...) should explain *why* they are incomplete and thus demonstrate a need for this gap to be filled.

Try to avoid utilizing words like “neglected,” “failed,” or “ignored” when critiquing researchers in your field. Instead, frame the gap in more positive terms.

Common phrases for showing that the current practices are incomplete, unsatisfactory, or inconclusive include:

- However, the commercial viability of X is currently limited because...
- Although X practice has been used widely, it inadequately addresses...
- Whereas research has shown X, it overlooks...
- While current findings are promising, more research is needed because...
- X’s results have raised new questions that need to be explored, such as...

Example 1

When we consider the same waveform circulating through each antenna element with a very small relative time shift, as presented in this paper, it seems that achievement of good cross-correlation properties is simply impossible. **However**, the received results demonstrate the opposite. Consequently, the circulating codes for coherent MIMO deserve **careful reconsideration** and analysis. [1]

Example 2

This paper **shows some of the limitations of this white space approach**, describes example mechanisms for gray space sharing in which devices are given access to spectrum that is already in use, quantitatively demonstrates the value of such schemes, and identifies policy and governance reform that could facilitate use of some of these gray space sharing mechanisms. [2]

Example 3

However, existing synchronization mechanisms consume **an exorbitant amount of** energy due to the periodic exchange of messages used to adjust local clocks. [3]

Move 4: Filling the Gap

In this fourth move, researchers must show how their current research or research proposal is a timely, necessary, or innovative solution to effectively fill the existing gap.

Common phrases that researchers use to signal that their research is timely, necessary, or innovative include:

- This paper describes a new solution for...
- We offer a novel approach to...
- The goal of this paper is to explore a new theory about...
- Here, we investigate the previously unstudied X...
- Unlike existing approaches to X, our approach emphasizes...
- We will suggest ways to address shortcomings in current approaches to X.

Example 1

This paper describes a solution for the proposed waveforms **based on the use of a novel and technically simple solution of** transmitting only one waveform circulating from one antenna element to another (or from one subarray to another) with a very small relative time shift. [1]

Example 2

This paper shows some fallacies and limitations of this white space approach, **describes example mechanisms for** gray space sharing in which devices are given access to spectrum that is already in use, **quantitatively demonstrates the value of** such schemes, **and identifies** policy and governance reform that could facilitate use of some of these gray space sharing mechanisms. **In particular, this paper focuses on** primary–secondary gray space sharing, in which systems either have primary or secondary rights, and those with secondary rights are prohibited from causing harmful interference to those with primary rights. [2]

Example 3

The main contributions of this paper are as follows. We present a novel hardware clock synchronization **solution** that allows nodes in the network to receive a stable global clock tick by tuning to the electromagnetic energy (EM) radiating from existing AC power lines. **Unlike other** hardware-based clock synchronization solutions that require transmitters, **our system is able to** utilize the existing signals radiating from AC power-lines tens to hundreds of meters away. **In contrast to** existing systems like the WWVB atomic clock broadcast and GPS time receiver, **our system** operates extremely well indoors and around the periphery of buildings. [...] **We present the design of** a low-cost and low-powered device called a Syntonistor which uses these induced signals to provide clock synchronization in wireless devices. By leveraging this highly available common clock source, **we can now provide** synchronization using significantly less power than existing message passing solutions. [3]

[1] Adapted from G. Babur, P. Aubry, and F. Le Chevalier, "Space-Time Radar Waveforms: Circulating Codes," *Journal of Electrical and Computer Engineering*, vol. 2013, pp. 1-8, 2013.

[2] Based on J. Peha, "Spectrum sharing in the gray space," *Telecommunications Policy*, vol. 37(1-2), pp. 167-177, 2013.

[3] Adapted from A. Rowe, V. Gupta, and R. Rajkumar, "Low-power Clock Synchronization using Electromagnetic Energy Radiating from AC Power Lines," *Proceedings of the 7th ACM Conference on Embedded Networked Sensor Systems*, Nov. 2009.