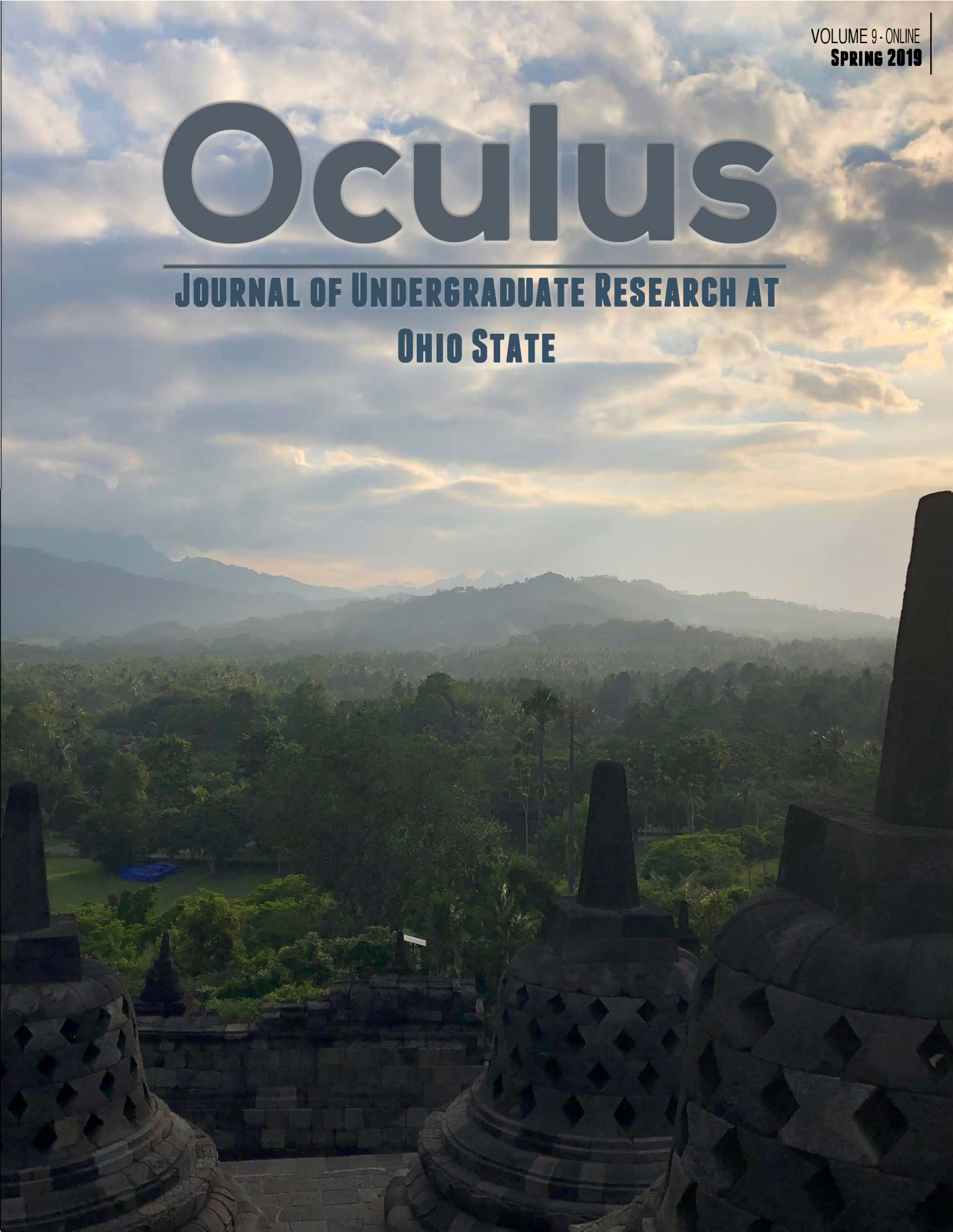# Oculus

## Journal of Undergraduate Research at Ohio State

# Letter From the Editor

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The Journal of Undergraduate Research is a peer-review publication; all of our staff members are fellow undergraduates who share a love of research with our authors. The editorial process is strenuous; all manuscripts are examined by a team of editors who determine if the work should be accepted for a second round of editing before approval for publication is awarded. My hope is that you, reader, will enjoy perusing this publication, appreciate the work of our authors and editors, and learn something new along the way.

Kind wishes,

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# Sentinel Songs: Monuments, Poetry, and the Lost Cause Narrative in Collective Memory

By Stephen G Carlsten

## Abstract

Over the past few years, Confederate monuments have become a regular and controversial topic in American discourse. To explore the historical and cultural contexts of these contentious monuments, this paper examines primary source material spanning approximately seventy-five years in the postbellum American South. With poetry possessing a far more ubiquitous presence in the 19th-century American public sphere, analysis of patterns in poetic discourse reveals larger contextual evidence about the monuments and the culture that erected and dedicated them. By tracing patterns in both the poetry and ceremonial rhetoric of monuments and monument dedications across the late nineteenth and early twentieth centuries, I employ Halbwach's collective memory theory to understand contemporary monument sentiments. Within the theoretical framework of collective memory, poetry, rather than serving a purely artistic social function, acts also as a "memory carrier" that transmits collective traumas and ideologies to future generations. Consequently, the ritual of monument memorialization seems to have preserved the mythos of the Confederate Lost Cause among Southern whites to the present day.

Across the contemporary American South, many thousands of aging Confederate Civil War monuments continue to dot the Southern landscape. Once unveiled before grandiose, ceremonial audiences, these monuments—from the familiar "common soldier" standing atop stone pillars to bronze castings of stoic generals on horseback—gradually became a soamewhat ordinary characteristic of Southern cities and towns (O'Connell 9). Recently, however, they have soared into the forefront of American political discourse, igniting fervent debate about their place in the public sphere. Split along radically opposed ideological lines, arguments for and against the monuments' place in public spaces suggest either that their removal constitutes a form of cultural erasure, that they belong in museums where they can be contextualized, or that they should be altogether destroyed (Barker 125).

With the proposed removal of Confederate monuments still engendering resistance among many Southern whites, scholars may seek to understand how the "Lost Cause" still influences Southern identities. Contesting how the Civil War should be remembered, the "Lost Cause" narrative articulates a Southern-centric notion of the war, arguing, for example, that states' rights—as opposed to the issue of slavery—was the primary cause of the conflict (Janney 40). French philosopher and sociologist Maurice Halbwachs' theory of collective memory argues that memory, more than a strictly individual experience, functions as a "reconstructive social framework to ensure the continuity of collectivity" (Kreiser 510). By examining monument memorialization through a collective memory framework and studying the discourses surrounding monument, dedications, and memorial groups like the Ladies Memorial Associations (LMAs), this article argues that poetry acted as a crucial memory-making tool in the formation of the Lost Cause narrative.

In the immediate years following Confederate surrender, poetry fulfilled an urgent need for mourning Southerners: memorializing their dead. Abram J. Ryan—"the Poet-Priest of the Lost Cause" (Sedore 9)—published "Sentinel Songs" in May of 1867, ostensibly concerned about "the fact that in a few places and a for a short period of time, Federal authorities had forbidden the erection of monuments to the Confederate war dead" (O'Connell 70-71). "Sentinel Songs" assigns a moral duty to poets and their craft:

> When falls the soldier brave
> Dead—at the feet of wrong,—

> The poet sings, and guards his grave
> With sentinels of song (Another Gem).

Without the legal right to construct monuments, poetry itself would have to take up the task of defending the burial sites of fallen soldiers.

Federal authorities eventually lifted the ban on monument construction, but "Sentinel Songs" would continue to appear in monument discourses. Alluding to its final and most prolific stanza, Father H. A. Picheret offered a prayer for the dedication of a monument to Jefferson Davis in Jackson, Mississippi: "But if, in the course of the ages, the all-destroying hand of time should cause it to crumble into dust, grant, O Lord, that the remembrance of the knightly deeds of our Confederate heroes may never die out in the generous hearts of the Southern people" (Confederate Dead of Mississippi 297). Mrs. Luther Manship would later in the ceremony recite the final stanza in front of "more than twenty thousand" attendees:

> When marble wears away,
> And monuments are dust,—
> The songs that guard our soldiers' clay
> Will still fulfill their trust (Confederate Dead of
> Mississippi 313).

Inscribed on numerous Confederate monuments, the final stanza of "Sentinel Songs" suggests that poems possessed the capacity to preserve soldiers' memory more permanently than could any monuments. Ryan, himself a living sentinel of the Lost Cause, traveled and published extensively throughout the South until his death in 1884 (O'Connell 189). Meanwhile, when Ryan was crafting postwar poetry and local LMA chapters had set to work with the pragmatic concerns of interring Confederate soldiers, a Kentucky veteran's ode to Mexican-American War dead had been redeployed for a new task. In May of 1866, Theodore O'Hara's "Bivouac of the Dead"—written a decade before the outset of the Civil War—found a role in dedicating the Resaca Confederate Cemetery in Georgia. An 1867 article in the Macon Weekly Telegraph recounted the local ladies' efforts and concluded with stanzas from O'Hara's somber elegy:

Rest on, embalmed and sainted dead!
Dear as the blood ye gave;
No impious footstep here shall tread
 The herbage of your grave;
Nor shall your glory be forgot
While Fame her record keeps,
Or Honor points the hallowed spot
Where Valor proudly sleeps
(Confederate Dead at Resaca 4).

O'Hara's diction, in keeping with the traditions of commemorative war poetry, paints a deeply religious portrait of the fallen soldier—the "sainted dead" cannot be besmirched by the "impious footstep," nor forgotten while "fame her record keeps." "Bivouac of the Dead" captures a familiar and non-sectarian reverence for military dead, and because it did not express the animosity coded into other postwar Southern poems, "the Federal Government was to place [the poem] over the gateway to the Federal Cemetery at Arlington and still later to use in all the cemeteries of Federal soldiers throughout the land" (Coulter 58).

To understand the cultural significance of "Bivouac of the Dead," one must visualize the massive audiences attending monument dedications—"Crowds estimated in the hundreds of thousands . . . the largest peacetime assemblies to this day"—hearing passages of the poem recited by Confederate politicians and veterans as famous as contemporary celebrities (Sedore 9). Captain Gordon McCabe, a regular speaker at dedications, read poetry at more than a few monument ceremonies; he recited passages from "Bivouac of the Dead" at the Pegram Battalion Association's 1886 reunion "to great praise and reverie" (Annual Reunion 23). And, after the extravagant ceremonies had concluded, monuments bearing inscriptions of the poem would transmit O'Hara's poetic sentiment to many future visitors.

In An Illustrated Guide to Virginia's Confederate Monuments, Timothy Sedore describes the public relationship with war monuments: "There was something worshipful, exalting, and ultimately quasi-religious about the [monument] movement . . . in the soldier there is something of the American Eucharist: the ceremony of dedication was a veritable anointing, a bonding of the past with the present" (Sedore 10). At this site of bonding, both the poem and the stone upon which it is inscribed act as a "memory carrier . . . through

which the chaos of social activities can be changed into a story . . . a kind of meta-narrative, rooted in the myths and archetypal images of a particular culture" (Kalinowska 427). Where Ryan sought to place sentinels over the graves of Confederate soldiers, O'Hara elevated their memory to a romantic, idealistic realm—an archive in a collective consciousness where only the venerable qualities of their cause remained.

However, although Confederate monuments mostly bear inscriptions of Ryan's and O'Hara's poems, Albert D. Oliphant of the Charleston News & Courier suggested in 1910 that "[p]reminently the greatest poetess of the war was Margaret Junkin Preston" (Oliphant 16). Preston's war poetry—like Ryan's and O'Hara's—dealt in notions of eternal martial glory, but her 1866 Beechenbrook: A Rhyme of War also conveyed a more notable contempt for the North:

The largess of their praise is flung
With bounty, rare and regal;
—Is it because the vulture fears
No longer the dead eagle? (Preston 55).

Preston's "rather invidious comparison of the vulture and eagle" may have been considered inappropriate by the "military rule and carpet-bag governments . . . still prevailing over the South" (Tardy 380; Address of Gen. R. E. Colston 36). Nonetheless, the 1866 edition of Beechenbrook achieved wide distribution: "We see no reason to doubt the entire veracity of Messrs. Kelly & Piet in announcing 'fifth thousand' on the title-page of this volume" (Tardy 381). Like the Ladies Memorial Associations that had formed across the South in the immediate aftermath of surrender, Beechenbrook avoided censorship because, according to Caroline Janney:

[W]omen might be best suited to take the lead in memorializing the South's Lost Cause. After all, if women were not political, then their actions could not be construed as treasonous to the U.S. government. Middle- and upper-class women of the LMAs thus served in the forefront of the postwar battle over Confederate memory, simultaneously allowing men to skirt the issue of treason and inaugurating the traditions of the Lost Cause as early as 1865 and 1866 (Janney 40).

Beechenbrook—"which, we should judge, would be immensely popular among the people for whom it was written"— could both "touch the hearts of thousands of readers" dealing with the immediate sociopolitical consequences of Southern surrender and "stir in their hearts that bitterness of hatred and that stubbornness of rebellion which did so much to prolong the late conflict" (Tardy 381; Oliphant 17; Tardy 381).

Preston's poetry also makes important assertions about the sanctity of monument space. "Stonewall Jackson's Grave"—"one of her best war poems"— eulogizes the famous Southern general (her brother-in-law), next to whom she is buried today in Stonewall Jackson Memorial Cemetery (Oliphant 17). Confederate General Raleigh E. Colston was elected to recite the following final stanza for his 1870 address before the LMA in Wilmington, North Carolina:

> Rare fame! rare name!—If chanted praise,
> With all the world to listen,—
> If pride that swells a nation's soul,—
> If foemen's tears that glisten,—
> If pilgrims' shrining love,—if grief
> Which naught may soothe or sever,—
> If THESE can consecrate,—this spot
> Is sacred ground forever! (Address of Gen. R. E. Colston 50).

Preston, like O'Hara and Ryan, attributes an eternal, spiritual significance to burial (and, by extension, memorial) space. Although her prominence had begun to fade by the time Oliphant was writing about her in 1910, Preston's assertion that the "spot is sacred ground forever" would have penetrated deeply into the collective consciousness of a Southern culture living under military occupation (Oliphant 17). Consequently, one can begin to see how "narratives of collective memory, which refer to the collective traumas of the past . . . act as contextual frameworks for group identity in the present" and why threatened identities might staunchly oppose the removal of monuments occupying space once deemed to be "sacred" (Kalinowska 426).

As time passed since the end of the war, the animosity reflected in Preston's work did not remain a core component of the Lost Cause narrative. In 1870, Confederate General Raleigh E. Colston lamented during an address to the Wilmington, North Carolina LMA that although "our own immediate sons and daughters will not believe [Northern] falsifications of history . . . perchance their children or grandchildren will believe them" (Address of Gen. R. E. Colston 38). Twenty-three years later, however, General Colston wrote a conciliatory preliminary note for the Southern Historical Society Papers' account of his 1870 Wilmington address:

> We had already appreciated the value of the Northern soldiers, and we now understand the motives which had impelled them to war from their point of view, motives just as honest, patriotic, and noble as ours. Prejudices on both sides have melted away, and there are now no better friends than those who fought each other in the blue and gray (Address of Gen. R. E. Colston 36).

Colston points to a shift in the Southern collective memory toward valuing a soldierly camaraderie that transcended sectional lines. This sentiment would be echoed in the works of later Southern poets who continued to shape the Southern public consciousness. When the most venerated of Confederate historical figures, General Robert E. Lee, passed away in 1870, the Virginia Ladies' and Lee Monument Associations both spearheaded statewide efforts to construct a monument to the late Confederate commander in the state capitol, Richmond (Monument to Lee 188-190). The Southern Historical Society Papers chronicled the monument's construction and dedication process in nearly two-hundred-page account: The Monument to General Lee. Planning and organization efforts spanned three decades and covered both logistical challenges—finding the right sculptor and designating the appropriate site—and stylistic choices, such as commissioning a poet who could handle the task of commemorating a military commander remembered as "a father rather than a leader" (Monument to Lee 187). James Barron Hope, a widely-celebrated poet whose work had been commissioned decades earlier to dedicate a Virginia monument to George Washington, had been "summoned once more to celebrate in song the deeds and virtues of Virginia's greatest son of her second Revolution, the peer of Washington in military genius, patriotism, constancy and valor" (Monument to Lee 209). Hope died just days before the ceremony, having finished "Memoriae Sacrum" on his deathbed

(Monument to Lee 209). Because the late Hope could not read it himself, Captain McCabe, "a gallant soldier, an accomplished scholar, a poet of no mean abilities himself, and the intimate personal friend of Hope . . . was recognized by all as the man for the occasion" (Monument to Lee 209). McCabe read the poem in its entirety—all two-hundred-and-fifty-two lines—his recitation "frequently interrupted with applause" (Monument to Lee 213).

"Memoriae Sacrum"—sacred memory—at once conveys a softening of sectional resentments, an argument for the truth inherent in the Southern cause, and an effort to vindicate "the [Virginian] social order / which gave us men as great as [Washington and Lee]" (Monument to Lee 211). The poem's voice embodies a "we" that speaks on behalf of the (white) Southern population:

> Peace had come. God Gave his blessing
> On the fact and on the name!
> The South speaks no invective,
> And she writes no word of blame;
> But we call all men to witness
> That we stand up without shame!
> (Monument to Lee 216).

While Colston, in 1870, had expressed his anxiety over the future remembrance of the Confederate cause, Hope's collective speaker assuages Colston's fear with broad assertions about the destiny of "truth" in the course of history:

> God and our consciences alone
> Give us measures of right and wrong.
> The race may fall unto the swift
> And the battle to the strong;
> But the truth will shine in history
> And blossom into song (Monument to Lee 216).

If one sentiment runs common among the vast breadth of poetry and speeches written and read for monument dedication audiences, it is unquestionably the notion that with the passage of time, history would reveal the "truth" undergirding the "Lost Cause" for which the Confederate South fought. Hope's appeal to a changeless truth recalls Ryan's plead of the poetic sentinel: guard the memory of the Confederate dead against the erosion of time.

But sentinels of memorialization cannot defy the reconstructive nature of collective memory. "Memoriae Sacrum" reveals an interesting reconstruction: a veneration of the figural Confederate rebel. In the earlier years of the Reconstruction era, Confederate discourses renounced the label of rebel. Just a few years prior to McCabe's recitation of "Memoriae Sacrum," General Bradley T. Johnson "made a defence [sic] of Confederates from the charge of being 'Rebels' and 'traitors' well worthy of preservation in [The Southern Historical Society's] records" (Maryland Confederate Monument 429). Johnson argued for the Confederacy's right to secession, the legal implication of which being that the Civil War would instead be a war fought between sovereign nations and not a rebellion. He also stressed that insurrection against the Union could carry the legal consequences of treason for every complicit Confederate soldier. To Johnson, the legacy of rebellion damaged Southern veterans' reputations, and he worried that future generations of Southerners would remember their fathers as "felons who vainly attempted to destroy the Union" (Maryland Confederate Monument 430).

In "Memoriae Sacrum," however, Hope reminds his audience of America's first "rebel"—George Washington. Hope's comparison of Lee and Washington effectively links an ideological "right to revolution," the ideology which impelled America's founders to rebellion, with the Confederacy's perceived duty to overthrow a "tyrannical" Northern government—a duty cemented still as a central tenet of the Lost Cause narrative (Barker):

> These two shall ride immortal
> And shall ride abreast of Time;
> Shall light up stately history
> And blaze in Epic Rhyme—
> Both Patriots, both Virginians true,
> Both "rebels," both sublime
> (Monument to Lee 215).

Whether Hope chose to enclose "rebels" in quotation marks or the Southern Historical Society Papers recorded McCabe's inflection of the word signals regardless that acceptance of the title had not permeated Southern culture at the time. Johnson may have been surprised that future generations of Southerners would remember the Confederate Rebel with fondness

rather than disdain.

With Reconstruction coming to a close and the Southern economy achieving relative stability near the turn of the twentieth century, a new generation of women's organizations, such as the United Daughters of the Confederacy, oversaw a rapidly accelerating pace of monument construction throughout the South (Winberry 26). The Southern public, it seems, had not shown any signs of forgetfulness half a century after the end of the war. Confederate Veteran, an immensely popular publication that circulated in the South from 1895 to 1932, articulated the "Myth of the Lost Cause" in prose and poetry for many readers born after surrender in 1865. The first issue contained Ryan's most popular poem, "The Conquered Banner" (King Evans 239). Moreover, the magazine served as "the official organ first of the United Confederate Veterans and later of the United Daughters of the Confederacy, the Sons of Confederate Veterans, and the Confederate Southern Memorial Society" (King Evans 240). With an organized network of memorial and veterans' associations, a central literary hub for promoting events and disseminating Lost Cause rhetoric, and a healthier southern economy, social conditions were ripe for monument construction. And, with new monuments came new dedications—and a new generation of poets to dedicate them.

A Charlottesville native and Virginia State Senator, James Lindsay Gordon, was born in 1860; he was a child of five when Lee surrendered at Appomattox ("Ballad of the Sunlit Years"). "[D]istinguished for his eloquence as a political and forensic speaker," his poetry reached Southern audiences at monument ceremonies, although he only published Ballads of the Sunlit Years (a compilation of his poetry) at the very end of his life in 1904 ("Ballad of the Sunlit Years"). A 1904 edition of Confederate Veteran featured Gordon's "An Unknown Confederate," a short, four-line poem:

"Jim —, of Biloxi." That is all.
It is graven into the granite wall
Where the monument rises fair
Into the soft Virginian air (Confederate Veteran 426).

Gordon's speaker refers to an already-constructed monument, suggesting that a culture of the monuments themselves had already begun to manifest throughout the South.

In 1890, at the dedication of the Fairfax County courthouse monument in Virginia, Gordon read a poem he had composed for the ceremony. With an ethereal tone reminiscent of Hope's "Memoriae Sacrum," the dedication expressed a faith in a romanticized concept of history:

As long as valor and faith on earth are cherished,
And men shall honor the brave
Bright will grow the story of those who perished
For a cause they could not save,
Till on history's changeless page serene and glorious,
While the spirit of truth find breath,
Their deeds will glow through the eons of time, victorious
Over defeat and death (Fairfax Monument 127).

Gordon, like Hope, asserts a "changeless" nature of history—an idealistic conception that truth and history are one-and-the-same. However, within the theoretical framework of collective memory, history, like an individual's memory, conforms to other externalities than an objective historical record; history itself emerges from a constant process of narrative reinforcement and reconstruction. Colston feared the influence of a Northern historical narrative, and Johnson worried that future Southerners would remember the Confederate cause with shame. However, in spite of the fears expressed in the speeches of Confederate military personalities, the narrative of the Lost Cause seemed to cement itself only more firmly in Southern memory with every new monument built.

Charlottesville, Virginia (Gordon's hometown), is also home to a monument of Robert E. Lee dedicated in 1924—ninety-three years prior to the "Unite the Right" rally that commanded America's public attention in August of 2017 (Fausset and Feuer). John S. Patton published a comprehensive account of the monument's history and ceremony proceedings for the Albemarle Charlottesville Historical Society the same year. As per usual among monument dedications, events included parades, speeches, and poetry recitations. Many of the addresses given focused on contested histories about the war. It was Colston who had predicted in 1870 that "[our] descendants will see these slanders in Northern and probably in European publications—perhaps even in the very text-books of their schools (for unfortunately we Southerners

write too little)" (Address of Gen. R. E. Colston 41). W. McDonald Lee, the Commander-in-Chief of the Sons of Confederate Veterans, echoed Colston's worry almost fifty-five years later:

> The South is truly deficient in advertisement. Ah, that is the trouble with us—the lack of written history. We would not discount others, but others are not doing the South justice. Some twenty years ago, Judge Moffett, of Roanoke, and myself, working on the History Committee of the Sons of Veterans, found Elson's history used in practically every school in Virginia. I cannot tell you because of the ladies present what abominable stuff was in that history, in such horrible terms that you would not wish your twenty-year-old boy to read (Patton 41).

Clearly, however, Southerners born after the war, like Don P. Halsey of Lynchburg, had not been swayed by Elson's history books. Speaking in front of the dedication audience, Halsey proclaimed that "I am one of the generation born after the war, but the son of a man whose proudest boast was that he was a soldier of the South, and I would not exchange that heritage for all the gold and silver piled up in the treasury vaults" (Patton 20). With monument construction continuing throughout the South well into the mid-twentieth century, dedication and rededication ceremonies created recurring sites of poetic memorialization's discursive impact on Southern communities (Sedore 10). And with thousands of monuments occupying public space throughout the South, the permanence of poetic discourses etched into the very stone and bronze of the monuments themselves would ensure that memorial poetry's rhetorical power would continue to act on the collective Southern memory.

As such, with a deeply-rooted culture of Confederate memorialization firmly implanted in (white) Southern collective memory, one can begin to imagine why proposed monument removals might generate anxieties among communities programmed by a Lost Cause collectivity. After all, poetry and monument memorialization had not only implored Southerners to remember; it had also bemoaned the day that they might forget. The most commonly referenced poem among those inscribed on Confederate monuments is Rudyard Kipling's "Recessional":

> God of our fathers, known of old,
>    Lord of our far-flung battle-line,

> Beneath whose awful Hand we hold
>    Dominion over palm and pine—
> Lord God of Hosts, be with us yet,
> Lest we forget—lest we forget! (Sedore 18).

Although Kipling published "Recessional" for a British audience, the poem's connection of religion and memory made it transposable to a Southern context. Kipling's speaker prays that a collective "we" not forget a memory bound to a cultural narrative such as the Lost Cause. The cautionary rhetorical force of "Recessional" and its immense popularity in monument discourses undoubtedly influenced Southern memory. Indeed, today, self-identifying Southerners still disproportionately support praise of Confederate leaders in public discourse, assert that the war was fought over states' rights, and feel a positive or neutral reaction to the Confederate battle flag (Civil War at 150). Although many Southerners denounce the white nationalists who perpetrated violence at the Charlottesville protests in 2017, deconstructing a collective narrative with a century-and-a-half of cultural imprinting will certainly require more than the removal of monuments to a Lost Cause not quite yet forgotten. In addition, those who work toward the end of white supremacist ideals embodied by Confederate monuments should investigate and understand the power of poetic rhetoric and its action on collective memory to more completely rewrite their place in American society.

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# Examining Rate Priming on Information Processing

By Coryn Coleman

## Abstract

The current study investigated the effect of a musical prime on an individual's reading rate, reading comprehension, and processing speed. This research further examined if there is a correlation between reading speed and reading comprehension. Music and language primes have been shown to affect processing speed, such that when participants were exposed to a slow prime, language production slows down, and vice versa for fast primes (Jungers, Hupp, & Dickerson, 2016). This effect of priming has been observed in other cognitive capacities such as decision-making (Buelow, Hupp, Porter & Coleman, 2018), suggesting that the rate of prime could change processing speed across domains. The current study sought to further support this theory by testing processing speed in motor movements and reading rate. These domains were measured when participants completed the Purdue Pegboard Task and The Nelson Denny Reading Test after being exposed to 3 minutes of a classical music prime. The musical prime was manipulated to have either a slow or fast tempo. It was observed that there is a positive correlation between reading rate and reading comprehension, but that the rate of prime did not affect processing speed, reading rate, or reading comprehension.

## Article

On the typical college campus today, students can frequently be seen listening to their favorite music with a pair of headphones. They may be walking to class or walking to their dorm, but do they ever think about how this can affect their processing of information? According to previous research, when a person is exposed to a fast prime, they tend to have faster cognitive functions, and the opposite when exposed to a slow prime (Buelow, Hupp, Porter, & Coleman, 2018; Jungers & Hupp, 2009; Jungers, Hupp, & Dickerson, 2016). A prime is a stimulus such as music or speech that a participant is exposed to before an experiment or task. When applied to music, it is expected that participants exposed to fast music will process information faster, and those exposed to slow music will process information slower. This leads to the question of whether college students can better comprehend a textbook or lecture if they listen to fast music

## Effect of Rate Priming on Cognition

Previous research has shown an effect of rate priming on different cognitive domains such as language production, processing speed, and decision-making. Specifically, researchers found that participants produce speech differently based on the speed of a prime (Jungers et al., 2016). In the study, there were two separate experiments: one with a speech prime and the other with a music prime. In the first experiment, participants looked at a picture being described slowly (60 beats per minute) or fast (120 beats per minute). Next, the participants would be shown another picture, and told to describe it. When exposed to a fast language prime, participants spoke faster than when exposed to

the slow prime.

In the second experiment, Jungers et al. (2016) performed the same procedure with familiar musical melodies as primes. Participants were shown the title of the song while listening to it at a slow (60 BPM) or fast (120 BPM) pace. After each song, participants were shown a picture, and told to describe the picture. Once again, when exposed to the fast prime, participants spoke faster than when exposed to the slow prime. These findings were replicated using unfamiliar musical melodies (Jungers & Hupp, 2018). This research showed that both music and language primes affected how fast participants described the pictures, specifically that participants spoke faster when exposed to a fast prime than when exposed to a slow prime. This could suggest that there is a common temporal processing mechanism between music and language, or even domain generality of temporal processing.

In a recent study, researchers measured how speech rate affected performance on a decision-making task (Buelow et al., 2018). Participants listened to a story recorded at a slow pace (145 seconds long) or fast pace (98 seconds long), and the control group did not listen to a story. Participants then completed the Hungry Donkey Task (HDT), which is an adaptation of the Iowa Gambling Task (IGT), to measure risky decision-making. The researchers found that when participants were exposed to a slow language prime, they took longer and made more advantageous decisions on the HDT than those in the fast-prime group, thus showing that slow language primes lead to slower cognitive functions, such as decision making.

In addition to language production and decision-making, processing speed is also affected by the rate of primes. A study conducted by Ilie and Thompson (2011) looked at the relationship between music and processing speed. Their first experiment looked at how exposure to music affected emotion, processing speed, and creativity. They manipulated the music to have different pitches (high or low), rates (fast or slow), and intensities (loud or soft). To measure processing speed, they had participants complete a routine task, which consisted of identifying wingdings (i.e., arrow or teardrop) from a one-page document, after being exposed to 7 minutes of the manipulated classical piece. Ilie and Thompson (2011) found that those who were exposed to the slow music before the routine task took longer on this task than those exposed to the fast music. However, the rate of prime was confounded with their

other variables: emotion and arousal. The current study expands on the effects of rate of prime by investigating if the rate of music prime extends to other measures of processing speed, such as those involving the cognitive domains for reading, and to isolate the effect of rate of prime from other confounds.

## Reading Rate and Comprehension

For some, reading comes easily, allowing them to process the information faster, but for others, it can be tough, so they process information much slower (LaBerge & Samuels, 1974). Skilled readers have better word recognition, which involves fewer attentional resources (Jenkins, Fuchs, van de Broek, Espin, & Deno 2003). Attentional resources can then be dedicated to better comprehension of a text. In contrast, less skilled readers attend more to word recognition, leading to poor comprehension (Jenkins et al. 2003). In several studies, researchers have investigated how reading rate can affect comprehension, and some have indicated that there is a correlation between natural reading speed and the comprehension of a text. Similar results were found in previous research measuring reading rate and reading comprehension in sixth and seventh graders (Hale, Skinner, Wilhoit, Ciancio, & Morrow 2012). Skilled readers exert less effort into reading and read faster than less skilled readers, who tend to read slower and less often because it requires more effort (Hale et al., 2012).

Breznitz, DeMarco, Shammi, and Hakerem (2001) looked at how reading speed affects adults' comprehension of a text by manipulating how fast they read. Participants started with 17 passages from the Test of English as a Foreign Language (TOEFL), which they read at their own speed. When each passage was done, there was a comprehension question. The test was conducted electronically, allowing reading time to be calculated. After the self-paced portion was completed, researchers calculated an individual's fast-paced reading speed based off of the passages they comprehended particularly well. To manipulate the fast-paced speed, researchers based the new speed on the individuals' average reading rate on the self-paced portion of the assessment. To force the fast pace on the reading passages, words would disappear individually from the beginning of the passage until it was completed, and then the comprehension question would appear. Breznitz et al. (2001) found that when participants' reading rate

was manipulated to be 12% faster, their comprehension scores could increase up to 21.8%.

One possible explanation is that faster reading speed allows the working memory (WM) to be used more efficiently (Breznitz & Share, 1992). WM is a form of memory that is used when completing demanding tasks, allowing pieces of information to be stored temporarily (Baddeley & Hitch, 1974), and has been found to be an important predictor of reading comprehension (Seigneuric, Ehrlich, Oakhill & Yuill, 2000). WM has a limited amount of resources used to maintain information (Baddeley & Hitch, 1974), which could suggest that Breznitz and Share's (1992) theory is on the right track. Because WM is only able to hold a limited amount of information, reading faster may allow subjects to remember more in that short period of time, as they are taking in information at a faster rate. If reading speed can be manipulated by a rate prime, it may be able to influence how much information participants can remember.

## Music's Effects on Cognition

Background music has been shown to influence processing; music affects concurrent processing in certain areas of cognition (Bottroli, Rosi, Russo, Vecchi, & Cavallini, 2014). Background music can have both positive and negative effects on cognition, depending on the task. For example, fast music can lead a participant to take less time on a processing speed task (Bottiroli, Rosi, Russo, Vecchi, & Cavallini, 2014; Ilie & Thompson, 2011). Additionally, it has been found that background music can have a positive effect on the Symbol Digit Modalities Test (SDMT), a processing speed task, when compared to no music and white noise groups (Bottiroli et al., 2014). Participants' declarative memory (semantic and episodic) and processing speed were assessed with concurrent background music (Mozart or Mahler), white noise, or neither. Participants in the Mahler background music condition showed higher scores on both the semantic and episodic memory tasks; those in the background music condition with Mozart had higher scores on the SDMT than those in the white noise and no music groups (Bottiroli et al., 2014). Researchers state that music that puts participants in an alert mood and state (i.e., fast music) can produce better scores on processing speed tasks (Bottiroli et al., 2014).

The effect of background music on reading speed has also been investigated. When listening to concurrent background music, reading speed can imitate the speed of the music playing. Kallinen (2002) had participants silently read a news article on their smart-device (such as a phone, or small tablet) while listening to music. Researchers measured how long it took participants to read the article; participants in a slow music group took much longer to read the article than participants in the fast group.

These studies mostly investigated the effect of background music on different tasks, but lacked investigation of the effects of music primes (i.e., music played before continuing onto a different task). However, music primes have been shown to affect processing speed (Ilie & Thompson 2011), language production (Jungers & Hupp, 2009; Jungers et al., 2016), and emotional processing (Ilie & Thompson, 2011). The current study is investigating generality of the effect by observing if a music prime affects processing speed, reading speed, and reading comprehension. Exploring how music primes affect subsequent processing will aid in the understanding of temporal processing more generally.

## Current Study

The current study presents the question: how does the speed of a musical prime affect subsequent processing speed, speed of reading, and reading comprehension? First, the Nelson Denny Reading Test (NDRT; Brown, Fishco, & Hanna, 1929) was used to measure reading comprehension and reading speed. Second, the Purdue Pegboard Task (PPT; Tiffin, 1968) measured general processing speed. The PPT involves putting pegs into a large board with two parallel rows of holes, and has been successfully used to measure processing speed across a variety of studies (Marczinski et al, 2012).

It is predicted that those who are exposed to a slow musical prime would process information more slowly and be slower on the PPT and NDRT tasks, compared those who are exposed to a fast musical prime. For reading comprehension, it is predicted that those who are exposed to the fast musical prime will have a higher comprehension score since they may process the information faster, compared to those exposed to the slow music prime.

# Method

## Participants

This study's final analysis included 96 college-age participants from a regional campus of a large midwestern university. They were enrolled in introductory psychology courses and received course credit for participating in this study. There were 47 males and 49 females with a mean age of 19.28 years (SD = 2.17). There was an approximately equal number of participants across rate priming conditions: slow n = 30, fast n = 32, control n = 34. The participants were predominately white (76.04%), but also included African-Americans (15.63%), and multi-racial people (4.17%). Additional participants were not included in the data analysis because they had serious mental or medical conditions (n = 2), English was not their first language (n = 11), or they had untreated vision, hearing, or attention impairments (n = 12). Two participants were excluded due to incomplete testing. Participants who appeared to be aware of the experimental manipulation were also excluded from the analyses (n = 8); this was determined by their response to the question, "What was the purpose of this study" on the demographics sheet.

## Procedure and Measures

This research was approved by the university's Institutional Review Board. Students volunteered through an online system that allowed them to sign up for research studies. Once they were in the lab, the participants gave informed consent electronically, and were tested individually. Participants were then randomly assigned to one of three groups: fast prime (music at 120 BPM), slow prime (music at 60 BPM), and control group (no musical prime). Participants in the two experimental groups were exposed to 3 minutes of music, (Serenade No. 4 in D Major 'Colloredo', K. 203: VI Andante by Wolfgang Amadeus Mozart), on the computer through headphones at either a fast or slow pace. The control group went directly into the first task. The music selection was manipulated through Audacity to have either a fast or slow pace, while still having the same pitch, tone, and volume. It was an instrumental classical piece without lyrics to ensure the prime remained non-linguistic, similar to the Ilie and Thompson (2011) study. After the musical prime, participants completed the

NDRT to measure reading speed and comprehension and the PPT to measure processing speed. Task order was counterbalanced; half of the participants completed the NDRT first, and the other half completed the PPT first.

The NDRT (Brown et al., 1929) measures vocabulary, reading rate, and reading comprehension. For the purpose of this study, only the reading rate and reading comprehension portion of the test was used in the most recent forms, G and H. The NDRT is completed with a provided answer sheet, reading booklet, and pencil. The comprehension portion consists of 7 reading passages and 38 multiple choice questions, with 5 answer choices each. The first passage of the test contains over 600 words, which allows the researcher to measure reading speed; the rest of the passages are no longer than 3 paragraphs, or 200 to 300 words. The test is limited to 20 minutes, and the first minute is used to measure reading rate. Participants start reading the passage, and when a minute passes, the experimenter says, "Time." At this point, the participant records what line they have reached, and then continues reading. Comprehension is scored based on the number of questions answered correctly: the number of questions correct out of 38, multiplied by two to be consistent with typical scoring procedures (Brown et al., 1929).

The second task is the PPT (Tiffin, 1968) used to measure processing speed. It is a board that has two parallel rows with 25 holes each. Pegs are placed in the top of the board in four divots, or bowl-like shapes. First, participants are instructed to use their right hand to put as many pegs in the board on the corresponding side in a 30-second time period. Participants must keep their other hand to the side as they place pegs in the board. The participant then does the same with the left hand, followed by both hands (entering pegs in holes adjacent to each other at the same time). The raw score is based on the number of pegs put in the board. A high score represents faster processing speed (Lafayette Instrument Company, 2015).

When the PPT and NDRT were finished, the participant completed a paper and pencil demographics form that measured basic demographic information as well as information regarding general visual, auditory, and attentional health. This form also asked the participants what they thought the purpose of the study was. Then the participant was debriefed, and they received participation credit and a piece of candy.

# Results

Each participant had three scores: PPT, NDRT rate, and NDRT comprehension. The score on the PPT is the total number of pegs placed on the board added across left, right, and both hand trials. A higher score indicates faster processing speed. The score for the NDRT reading rate is based off of the line of the reading passage reached at the end of the first minute. A higher score indicates faster reading rate. The comprehension portion of the NDRT is based off of the number of questions answered correctly (out of 38) multiplied by two, in order to maintain scoring consistency with previous research. A higher score indicates a higher level of reading comprehension.

A series of one-way ANOVAs were conducted to analyze the effect of musical rate prime on the PPT and NDRT across the three Music Prime Conditions (control, slow, and fast), as well as analyze the effect of reading rate on the number of questions answered correctly. In addition, a correlation between reading rate and comprehension was calculated for all participants, and one sample t-tests were conducted to determine similarity with normative data.

## Purdue Pegboard Score

One sample t-tests were conducted on each subset of scores (preferred hand, non-preferred hand, and both hands) to determine if there was a statistically significant difference between the PPT scores from this study's participants and normative data (as reported in Lafayette Instrument Company, 2015). Students scored significantly worse than normative data for all subsets. For preferred hands, students scored (M = 14.250, SD = 1.875) compared to (M = 16.13), t (95) = -9.824, p = < .05. For non-preferred hands, students scored (M = 13.364, SD = 1.597) compared to (M = 15.59), t (95) = -13.655, p = < .05. For both hands, students scored (M = 11.552, SD = 1.710) compared to (M = 13.18), t (95) = -9.28, p = < .05.

There was no effect of music prime on the total PPT score, F (2, 96) = .234, p = .792, preferred hand PPT score, F (2, 96) = .601, p = .550, non-preferred hand PPT score, F (2, 96) = .283, p = .755, or both hands PPT score, F (2, 96) = .090, p = .914. Refer to Table 1 for means and standard deviations across conditions. This pattern of results was identical only for those who received the PPT directly after the music prime (e.g., PPT as the first task). These results indicate that the rate of musical prime has no effect on processing speed.

*(Table 1 Below)*

## Reading Rate

The participants' average reading rate (i.e., line number) was worse when compared to the normative data for the NDRT. Students read significantly slower (M = 224.74, SD = 65.86) compared to normative data (M = 238.31, Brown et al., 1993), t (95) = -2.00, p = .048. There was also no effect of music prime on the NDRT reading rate score, F (2, 96) = .261, p = .771. Refer to Table 2 for means and standard deviations across music conditions. This pattern was identical only for those who received the NDRT directly after the music prime. These results show that rate of musical prime does not influence reading rate. (Table 2 on next page)

## Comprehension Score

The participants' average comprehension score was better on the NDRT, (M = 52.77, SD = 13.92) when compared to normative data (M = 48.50, Brown et al., 1993), t (95) = 3.007, p = .003.

Table 1

*Purdue Pegboard Score Subsets Across Music Conditions*

| Music Condition | Total Score Mean Score | Total Score Standard Deviation | Preferred Hand Score Mean Score | Preferred Hand Score Standard Deviation | Non-Preferred Hand Score Mean Score | Non-Preferred Hand Score Standard Deviation | Both Hands Score Mean Score | Both Hands Score Standard Deviation |
|---|---|---|---|---|---|---|---|---|
| Slow (n = 30) | 38.9 | 4.08 | 14.2 | 2.01 | 13.23 | 1.48 | 11.47 | 1.96 |
| Fast (n = 32) | 39.59 | 4.49 | 14.53 | 1.92 | 13.53 | 1.57 | 11.53 | 1.61 |
| Control (n = 34) | 39 | 4.48 | 14.03 | 1.73 | 12.32 | 1.75 | 11.65 | 1.61 |

Table 2
*Reading Scores across Music Conditions on the Nelson Denny Reading Test*

| Music Condition | Mean Score | Standard Deviation |
|---|---|---|
| Slow ($n = 30$) | 226.53 | 68.32 |
| Fast ($n = 32$) | 218.03 | 56.11 |
| Control ($n = 34$) | 229.47 | 65.86 |

There was no effect of music prime on the NDRT comprehension score, $F(2, 96) = .213$, $p = .808$. See *Table 2* for means and standard deviations across music conditions. This pattern of results was identical only for those who received the NDRT directly after the music prime. These results indicate that rate of musical prime does not influence reading comprehension. *(Table 2 above)*

## Reading Rate and Comprehension

A Pearson Correlation was run to analyze the relationship between reading rate and comprehension scores on the NDRT. There was a positive correlation between Reading Rate and Comprehension, $r = .567$, $p < .001$, indicating that a faster reading rate corresponds with better scores on the comprehension NDRT.

## Discussion

The aim of the current study was to see if music rate priming had an effect on processing speed and reading. This study also investigated if reading rate was related to reading comprehension. The results of this study show that the music prime had no effect on processing speed, reading rate, or reading comprehension. This finding could suggest that there is no domain general temporal processing mechanism. However, these results replicate previous findings that reading rate and comprehension are positively correlated.

The music prime did not affect the scores on the Purdue Pegboard Task (PPT), which can have multiple explanations. First, there may not have been a strong enough prime. Ilie and Thompson (2011) investigated how the speed (fast or slow), pitch (high or low), and intensity (loud or soft) of music affected processing speed and creativity, and found that slow music leads to slow processing speed on the routine task. Meanwhile, the current study only manipulated the speed of the music and kept intensities and pitch constant. However, Ilie and Thompson's prime was stronger because it was confounded with other factors such as emotion, so it is possible that rate was not a contributing factor in their study. Further, Ilie and Thompson (2011) measured emotion, and found when participants listen to something more upbeat or happy, it leads to arousal, leading to a participant to have a better score on a processing speed task (Bottiroli et al., 2014). Their prime was also seven minutes in length (instead of three minutes), which contributes to the strength of their prime. It is believed that the lack of prime strength could have been the problem in the current study because other research (e.g., Jungers & Hupp, 2009; Jungers et al., 2016; Kallinen, 2002) has found an effect of music primes. However, the music in the other studies was played concurrently with the task, was confounded with emotion, and was longer, leading to stronger effects of the music rate. Future research should assess emotion to see if it's effects on arousal also influence processing or reading speed rather than the rate of music itself.

Table 3
*Comprehension Score across Music Conditions on the Nelson Denny Reading Test*

| Music Condition | Mean Score | Standard Deviation |
|---|---|---|
| Slow ($n = 30$) | 52.73 | 11.39 |
| Fast ($n = 32$) | 51.63 | 15.83 |
| Control ($n = 34$) | 53.88 | 14.34 |

Another possible explanation for the lack of priming effects on processing speed could be that the PPT is not an appropriate measure of general processing speed. The PPT was originally used as a motor speed task, and later started being used as a processing speed task for a small handful of studies. Although the PPT is generally used for motor dexterity measurement, there is a positive correlation between motor dexterity and processing speed, suggesting that the PPT would have initially been a good measure of processing speed (Ebaid, Crewther, MacCalman, Brown, & Crewther, 2017). However, the effect of music primes may be specific to other types of non-motor processing tasks. Future research should use a different measurement for processing speed and assess other types of processing.

Future research should also investigate how music primes affect oral reading (out-loud) compared to silent reading (in the mind), due to the different methods for measuring accuracy and comprehension (Van de Boer, Van Bergen, & De Jong, 2014). With oral-based reading, comprehension is assessed using oral reading rate and accuracy (Tranin, Hiebert, & Wilson, 2015). Meanwhile, silent reading does not measure reading accuracy, allowing for less concentration on the pronunciation of the words (Schimmel & Ness, 2017), and less work on simultaneous demanding tasks. This saves more cognitive resources for comprehension of a text (Hale, Hawkins, Schmitt, & Martin, 2011; Schimmel & Ness, 2017). When reading silently, studies show that reading speed is faster and recall of the text is better, when compared to reading orally (Schimmel & Ness, 2017). Previous research has also shown that music primes affect language production (Jungers & Hupp, 2009; Jungers et al., 2016), suggesting music primes may affect oral reading differently to silent reading. Future research should also assess for reading difficulties and disabilities through self-assessment on the demographics sheet.

These results support previous research that a faster reading rate is correlated with better reading comprehension, but do not support research that music primes affect processing speed. Based on these results, listening to music before completing a task may not have a negative effect on the task. This information can be used for future research investigating the reading process and how music primes affect reading. Though this research did not find what was expected, it contributes to previous research on music primes by demonstrating the scope where music rate primes may not have an effect, and can influence future research on music primes. Although priming is a largely studied phenomenon, there is still much to be explored in the effects of music priming on cognition.

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# Rachel Dolezal: An Intersectional Analysis

By Brittney McIntyre

## Abstract

This paper uses intersectionality theory and identity politics to analyze the transracialism of Rachel Dolezal. I establish the social construction of racial identity, and the basis of all identity construction in white supremacist settler colonial logics. Using concepts of essentialism and identity politics, I then investigate the ways in which individuals define and perform racial identity. I include analyses on how Dolezal performs transracial identity, and the implications her actions have on social definitions and meanings of blackness. I then expand on Dolezal's appropriation of blackness and her conflation of physical appearance with cultural and historical identity. I discuss Dolezal's fixation as a means to cope with childhood trauma and, using this trauma as a point of departure, briefly examine the intergenerational passing of trauma, implicating Dolezal in the erasure of the voices and experiences of black women. I provide a brief discussion on colorism and privilege before moving to a comparison of transracial and transgender identities. Finally, I engage the power of social constructions and use de-colonial frameworks to assert that, while the concept of transracialism is not inherently at issue in the abstract, Dolezal's misunderstanding of racial identity in contextual and practical application creates tensions and challenges that are, in fact, quite problematic.

## Author's Note

The term "transracial" has been used in academic, creative, and cultural writing as a signifier denoting people adopted across race, often across countries or continents, and sometimes without fully formed consent. It also describes a type of family unit and a form of parenting. The "trans" in transracial has not historically meant a change in racial identity. However, in this paper, in an effort to maintain consistency across existing scholarly research and popular media around the individual circumstances of Rachel Dolezal, use of the term "transracial" signifies Dolezal's racial identity "shifting" from white to black.

## Introduction

*"I would have these imaginary scenarios in my mind where I was really a princess in Egypt and [my parents] kidnapped and adopted me. I had this thing about just making it through this childhood and then I'll be OK." (McGreal 2015).*

*"She recalls choosing brown crayons to draw pictures of herself with dark skin and curly hair, like the Bantu women she saw in National Geographic. She would hide in the garden, smear herself in mud, and fantasise [sic] that she had been kidnapped from Africa." (Aitkenhead 2017).*

Born in rural Montana to conservative Christian fundamentalist parents, Rachel Dolezal never identified with the family that raised her (Aitkenhead 2017). Amidst harsh punishments and alleged abuse within their religiously extremist household, Dolezal shaped a skewed and limited impression of black identity and began appropriating her creation in a myriad of ways (Aitkenhead 2017; Johnson, Pérez-Peña & Eligon 2015; McGreal 2015). At Howard, an historically black university, Dolezal found a new

chosen family; from then on, she began living her life as a black woman—eventually coming to accept the "transracial" identification ascribed to her by popular media (Aitkenhead 2017; Johnson, Pérez-Peña & Eligon 2015). The crux of Dolezal's argument is in the fluidity of race as a social construction, which she uses to insist that her way of living is beneficial, rather than harmful, to the black women and communities she supported in various ways throughout her tenure as an Africana Studies professor and as President of the Spokane chapter of the NAACP (Aitkenhead 2017; Johnson, Pérez-Peña & Eligon 2015). However, inherent in Dolezal's assessment is an abstractness which misunderstands the colonial roots of racial identity as it is defined and performed in the US and, in contextual and practical application, presents tensions and challenges that cannot be dismissed or obscured.

## Race: A Tool of Heteropatriarchal White Supremacist Colonizers

*"Her story has set off a national debate about the very meaning of racial identity, with some people applauding her message and goals," (Johnson 2015)."*

While debate continues within academic communities on the utility of racial categorizations (in biological research, mapping genetic diversity, and clinical settings), in the wake of the human genome project, most have arrived at the consensus that race as a biological concept is misguided (Foster & Sharp 2004). However, to acknowledge its social constructivity is not to say that race does not have powerful social and economic implications. The United States was created by colonial logics functioning in such a way as to enact racism through the very structures and institutions of society. The colonizer's profitable extraction of value from indigenous land required labor exploitation, arranged through chattel slavery (Arvin, Tuck & Morrill 2013). Racial hierarchy thus became a foundation of the nation's power and economy, and racism and other such institutions continue to actively perpetuate systematized discrimination and oppression of certain populations today.

The United States was built upon, and still exercises, laws that construct social categories to create vulnerability and subjugate marginalized populations. For example, US antidiscrimination law is narrow in scope, often basing outcomes in discrimination cases on sex or race, but rarely at the intersection of both

(Crenshaw 1989). As a result of this, gender discrimination is more widely recognized for white women and racial discrimination for black men; the experiences of black women are largely unaccounted for. Such laws, based on identity categories, including race, indigeneity, and national origin, effectively produce hierarchies and enshrine economic, social, and political vulnerabilities. These hierarchies serve to justify the exclusion of certain populations from what Dean Spade calls "programs that distribute wealth and life chances," as the operations of neutral administrative systems (Spade 2011). Through this understanding of the colonial function of race, we realize that "who one 'is'…is wholly relational to others, to culture, and to organizations in which one moves," (Levine-Rasky 2011). Identity is created and performed in relation to power structures.

## Defining and Performing Racial Identity

*"I did work and bought all my own clothes…That's not a typical American childhood life...I didn't resonate with white women who were born with a silver spoon. I didn't find a…connection with the story of the princess who was looking for a knight in shining armor." (Oluo 2017).*

*"Nothing about whiteness describes who I am." (McGreal 2015).*

*"I don't believe in race." (McGreal 2015).*

With this historical grounding, we can examine how racial identity is defined and performed by both those who claim and don't claim it as their own. Such definitions and performances may buttress or challenge dominant institutions and beliefs.

## Identity Politics & Essentialism

Identity politics direct social norms, performances, and interactions and can be used as a basis for one's political alignments. Multiple, varied, and at times contradictory individual and collective identities are tied to socio-historical meanings and structures of domination (Fuss 1989). With representation a critical factor in feelings of connectedness toward community and society, inadequate or discordant inclusion, as exhibited in Dolezal's case, can generate in the individual a sense of displacement with regard to personal identity status. This displacement can go so far as to com-

pletely negate or destroy one's personal identity, even racial identity (Fuss 1989).

Dolezal's statements in interviews and in excerpts from her book, *In Full Color: Finding My Place in a Black and White World*, speak to her flawed understanding of whiteness as a racial identity and misapprehensions around the nuance of race--particularly that black and white are not the only options, nor direct opposites of each other. Dolezal inexorably links whiteness to silver spoons and princess fairytales, superficial expressions of privilege with which she does not personally identify (Oluo 2017). In an inversion, Dolezal's logic is one shared by other groups of disenfranchised white, working-class Americans who cling to a racial hierarchy that promises some chance of escaping the commodification of capitalism so long as one is not black (Smith 2006).

Her statement, "I don't believe in race," asserts a preference for colorblindness. As an adjunct professor of Africana studies, Dolezal may have encountered the critique that it reinforces negative connotations of color, hinders the tracking of racial disparities in research studies, and ultimately perpetuates racism. Dolezal also argues that claiming black identity allows her to exist as her true self. While the social constructivity of race might imply that blackness is more about a feeling or conglomeration of lived experiences, that Dolezal feels the need to perform this blackness through stereotypical means without acknowledging the cultural histories upon which they are built belies her claim of not "believing" in race.

Definitions and meanings of black identity are maintained through individual and societal performances and impacted by the internal and external reactions to such performances. What Dolezal does in argument and practice essentializes the identity of black womanhood to the performance of normative stereotypes: "When race boils down, it's like hair, skin color, and eye shape — those are the three identifiers physically of race as a construct. So yeah, I definitely prefer to not, like, stay out of the sun," (Nightly News 2015). Why does Dolezal associate these performances with black womanhood? Even if we disregard the "one drop rule" and examine black women whose parents and grandparents identify and are accepted as black (rather than mixed-race or biracial), many such women will have fair skin; straight, wavy, or loosely curled hair; and possibly even be "white passing."

## Appropriation and Blackface

Dolezal's fixation with black hair culture--installing dreadlocks and box braids in her own hair, and becoming a hairdresser for black women in the wake of her public ousting--both essentializes and trivializes the historical and cultural experiences of black women concerning hair and beauty standards. A full analysis of these dynamics is beyond the scope of this paper, but taking into account the history of misogynist and white eugenic heteropatriarchal influences on the beauty practices of black women in the United States, Dolezal's choices and performances related to physical appearance ultimately prove to be an instance of both cultural appropriation and blackface. In interviews, Dolezal has been unable to express a fully-formed conception of this extensive and complex history, nor how, at the intersection of race and gender, black women's hair becomes a cornerstone of culture and personal identity, as well as a site of strategic resistance and activism.

Though Dolezal uses the term "glow," to describe the nature of her skin after she's spent significant time in the sun or used bronzer to darken her complexion, a quick Google search reveals the ubiquity of white women using blackface without acknowledging it as such. From social media influencers to runway and fashion magazine models (Lawler 2018; Rees 2013; Ward 2018), white women are consistently in the practice of "adopting" the features of black women for financial and social gain. Meanwhile, black women possessing the same features naturally are routinely left without the economic and social perks of having millions of Instagram followers or being on the pages of Vogue. Dolezal, whether she acknowledges it or not, is doing the same. In addition to her lack of critical understanding around superficial changes to hair and skin, Dolezal also lacks the intergenerational trauma and socioeconomic disadvantage of racist, misogynistic, and classist oppression experienced by black women in the United States (DeGruy 2005). Had Dolezal read the works of feminists of color during her time as an Africana studies professor, she may have considered whether her claim to blackness was ill-conceived. Many such writers discuss the need for unity while highlighting that this unity need not be identical –Audre Lorde even states explicitly, "we do not have to become each other in order to work together," (Anzaldúa 1987; Lorde 1988).

## Colorism & Privilege

*"Who's the gatekeeper for blackness?" (Brownson 2018).*

Even if Dolezal could move through the world "passing" as a black woman, eschewing the benefits of white privilege, she would still be doing so as a light-skinned black woman. Colorism remains a facet of racism Dolezal has yet to address. She does not seem to realize that she is actively practicing whiteness by creating social distance from the difficult circumstances of both the black women she emulates and the working-class white Americans she ignores. This practice of whiteness manifests in the denial of her own upbringing, as well as in her denial of the histories of whiteness and white privilege in the United States, and is cemented by her acknowledgement of white privilege and hierarchical superiority only after she shunned white identity and adopted blackness in its place (Hurtado & Stewart 2004).

Additionally, the idea of transracialism does not flow both ways; while light-skinned black women may be able to "pass" as white in certain instances—dark-skinned black women do not have the same privilege. The spectrum of colorism-related privilege is fluid, but still operates within definitive boundaries; performance of racial classifications deviate from whiteness as the default. The reason Dolezal is not and cannot be a black woman is that, though she can have pseudo-experiences of racial oppression (i.e. being racially profiled for a traffic ticket), and can have a real fear for the lives of her black children, she can only have these experiences and fears in the context of having grown up a white girl in a white supremacist society—a girl who at one moment decided she wanted to move through the world identifying as black. Conversely, women who grew up black in the same white supremacist society can never have the experiences she had as a white woman and, in many cases, can never even have pseudo-experiences. Black women who are light-skinned enough to "pass" likely also have to deal with light-skinned guilt, a burden with which Dolezal seems unafflicted.

## Comparing Transgender and Transracial Identity

Dolezal does not consider herself transracial. She considers the term reifying of white supremacy,

but has come to accept its application to her from others (McGreal 2015). She also rejects popular comparisons between her identity and transgender identity. However, within the context of this paper, it is worth briefly comparing Dolezal's transracial identity with transgender identity.

## Inherence of Identity

One assertion holds that the difference between Dolezal's actions and those of trans individuals is that her decision to identify as black is an active choice, whereas gender transition is almost always involuntary (Talusan 2015). This is well-intended but misguided. In the context of the social construction of identity (by hierarchal, discriminatory, and oppressive norms), racism and misogyny are both tools of colonialism (Driskill 2010). In this regard, the concept that race is binary, or fixed within specific delineations of what someone is or is not, parallels the dimorphic construction of gender. Stating that transgender people have no choice in their gender identity reifies the heteropatriarchal notion of gender as static and dimorphic rather than fluid and multidimensional. Similarly, the assumption that race is rigidly definable leans heavily on white supremacist eugenics logics, such as the "one drop rule." Had Dolezal been able to prove via DNA testing that she had even 1% "authentically" black ancestry, would critics have accepted her as a black woman?

Another argument differentiating transgenderism from Dolezal's transracialism purports that transgender people have to go through counseling under certified gender therapists, undergo hormone replacement therapy, and live in the targeted gender for at least a year before a gender therapist will sign off on genital surgery (Roberts 2015). While these factors may be true in the acquisition of transitional surgeries or official government identification, they are not required for a person to experience or claim a transgender identity. They are requirements to living and being accepted as an identity within the confines of a colonized society. In this vein, transgender identity and transracial identity alike are non-conforming practices that go against normative social definitions created and perpetuated by heteropatriarchal notions of being.

Yet another argument holds that the social identity of race is passed from one generation to the next, while gender is specific to the individual (Ander-

son 2017). This, again, leans heavily on white supremacist and heteropatriarchal binaries. If we accept gender identity as individual-specific, and that some transgender and non-heterosexual people are not necessarily "born this way," but instead actively select to live in ways that align with their chosen identities, it becomes irreconcilable to also accept the harmful logics permeating racial identity. To conclude that racial identity is based in genetic ancestry, and to require certain amounts of a specific genetic marker as indicative of such an identity, is based in dimorphic systems of belief grounded in white colonialism.

The arguments against the comparison of transracialism and transgenderism are invalid in the context of social constructivity, colonial-based dimorphism, and heteropatriarchal white supremacist eugenics. An intersectional argument against the comparison would necessitate questioning the claims Dolezal makes where the meanings and definitions of racial categorization have been shaped by forces other than colonial hierarchies and oppressions. By troubling colonizer tools and institutions, we can begin to consider whether racial categorization and racist power dynamics would be as consequential in a decolonized society.

## The Structural Power of Social Constructions

### Return to the Heteropatriarchal White Supremacy of Colonialism

Both race and gender are colonially-instituted categories that serve to promote and administer unequal distributions of power and wealth within capitalist institutions. Within these institutions, there are no benefits or privileges to declaring oneself transgender, whether one is a trans man or a trans woman; both carry social stigma and discriminatory oppression of varying degrees. While it may seem that the only benefits to declaring oneself transracial (or in the case of light-skinned black people, "passing") would be those for someone shifting from black to white, Dolezal had much to gain by living and performing as a black woman. She worked for the NAACP and taught college courses in a specialized subject matter, financially gaining from an identity that was not hers to declare. By accepting these economic and financial advancements, Dolezal also took them from women with legitimate

claim to black identity. Furthermore, Dolezal did this in Spokane, a predominantly white city, which could have benefited more from a white ally uplifting the voices of its black community than it did from a white woman claiming a black identity. Through her decision and actions, Dolezal perpetuated the appropriation and stereotyping of black womanhood, ultimately adding to the devaluation of black women's work and bodies.

## Dismantling Social Constructs

Racial identity is not the root issue in Dolezal's transracialism; rather, it is that her position and the critiques of it implicate the historical and ongoing imposition of colonial structures onto our society. The fundamental reason for discrimination against black women stems from settler colonial intervention in African affairs and the creation of the US chattel slavery system (Arvin, Tuck & Morrill 2013). The resulting identities and stereotypes "are the ossified outcomes of the dynamic intersection of multiple hierarchies, not the dynamic that creates them. They are there, but they are not the reason they are there" (MacKinnon 2013). Therefore, Dolezal's fundamental misunderstanding of the United States' legacy and perpetuation of colonialism via structural racism and heteropatriarchy aside, her desire to "be black" is not theoretically problematic. Where Dolezal's transracialism becomes injurious is in her argument that a white woman claiming black identity helps dismantle race as a social construct. Such methods of framing race conversations only serve to improve the circumstances of those deemed "deserving": light-skinned, feminine-presenting, normative women; the "least marginalized of the marginalized," (Spade 2011). If Dolezal truly wanted to exercise intersectional politics toward the deconstruction of race as a social institution, she would need to acknowledge the importance of recognizing the inequalities that exist within collective identities, and realize that this work does not lie in the dismantling of such identities or categories themselves but, rather, dismantling the structures and institutions that use identity to selectively impose vulnerability onto particular groups of people (Spade 2011). Dolezal would also need to recognize that diverse groups must work together to dismantle the various interlocking systems that constitute oppression (Cho, Crenshaw & McCall 2013), and that black women need white women to be allies while remaining firmly white.

# Conclusion

The existence of racial category itself is not the issue in Rachel Dolezal's claim of black identity. Even the bending or questioning of what it means to be part of a racial category can be thoughtfully examined and destabilized. The true contestation is in the meanings, values, and consequences of racial categorization, and the social hierarchies and oppressions these categorizations tangibly represent. In examination of these interlocking structures, we must employ a lens of native feminist theory to engage a resistance that contests the settler colonialism that continues to bolster heteropatriarchy and its white supremacist power dynamics (Arvin, Tuck & Morrill 2013).

It would have been more meaningful for Dolezal to "stay" a white woman and use her privilege to uplift the voices of the black women with whom she claims to identify. Instead, she co-opted an identity that was not hers to take, and in the process essentialized and embodied harmful stereotypes of black womanhood. "Native feminist theories...do not assume the permanence of settler colonial nation-states, but rather seek to explore and determine societal structures that do not rely on the maintenance of a nation-state," (Arvin, Tuck & Morrill 2013). The facts in the case of Rachel Dolezal ultimately call for implementation of such Native feminisms, through a dismantling of the white supremacist heteropatriarchal colonization we are currently and perpetually subjugated by. Without the constant enactment on and by society of colonial tools and tenets, it may be possible to envision a future that does not rely on racial categorization or racist power dynamics, one wherein Rachel Dolezal might be "transracial."

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# Manipulating Anger Does Not Affect Risky Decision Making

By Charles Cayton, Meisha N. Runyon, Thomas Crook, Melissa T. Buelow

## Abstract

To date, multiple studies have examined the influence of negative mood on performance on behavioral decision-making tasks. Self-reported negative mood was inconsistently associated with subsequent decision making, and a similar inconsistent pattern was seen when negative mood was manipulated in the study session. The present study sought to examine how deliberately inducing a particular negative mood, anger, would affect risky decision making. College student participants reported their political beliefs, then were randomly assigned to one of several mood manipulation conditions (political anger, anger, sadness, fear, control) prior to completion of standard behavioral risky decision-making tasks including the Iowa Gambling Task, Game of Dice Task, Balloon Analogue Risk Task, and Columbia Card Task. Results indicated an increase in negative mood in the anger condition following the study manipulation, but only minimal effects of negative mood on risky decision making across tasks. Future assessments of mood and decision making should address multiple negative mood affects in addition to manipulation techniques in order to determine if a specific mood and/or manipulation is contributing to an individuals' risky decision making.

**Keywords**: *anger, decision making, negative mood, Iowa gambling task, balloon analogue risk task, Columbia card task, game of dice task.*

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Decision making involves, at minimum, a choice between two options. In neuropsychology, decision making is often assessed via either self-report or behavioral measures. The present study focuses on one aspect of decision making, risky decision making, which can be defined as continuing to make suboptimal decisions in the face of known risks (Bechara, 2007). Performance on behavioral decision making tasks will be used to examine the level of individual risk. Understanding why individuals engage in risk-taking behaviors is important in predicting who will take risks and when. Positive and negative mood are frequently examined in relation to decision making task performance, with conflicting findings based in part on when mood is assessed and if mood is first manipulated. The present study examined the influence of negative mood, most notably anger, on risky decision making.

To date, several studies have examined the influence of different negative moods on behavioral decision-making task performance as, in general, mood can influence decision making (Forgas, 1995; Schwarz & Clore, 1983). Most have focused on the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), Balloon Analogue Risk Task (BART; Lejuez et al., 2002), Columbia Card Task (CCT; Figner, Mackinlay, Wilkening, & Weber, 2009), and Game of Dice Task (GDT; Brand, Fujiwara, Borsutzky, Kalbe, Kessler, & Markowitsch, 2005), which are detailed in Table 2. Utilizing self-report of current mood, several researchers found negative mood impairs performance on the IGT (Buelow & Suhr, 2013; Suhr & Tsanadis, 2007) and Cambridge Gamble Task (specifically depressed mood; Kaplan et al., 2006; Roiser et al., 2009), whereas others found higher levels of current self-reported depressive symptoms improves performance on

the IGT (Smoski et al., 2008). Still others found no relationship between self-reported negative mood and performance on the CCT (Buelow, 2015; Panno, Lauriola, & Figner, 2013). Several researchers instead examined the effects of direct manipulation of negative mood on subsequent behavioral decision-making task performance. Deliberately inducing a negative mood can lead to: improved decision making on tasks including the IGT (general negative mood induction, Buelow, Okdie, & Blaine, 2013; sadness induction, Chou, Lee, & Ho, 2007; Harle & Sanfey, 2007; Yuen & Lee, 2003); impaired performance on the IGT (sadness induction; de Vries, Holland, & Witteman, 2008); and no change in performance on the IGT or BART (fear/disgust induced; Heilman, Crisan, Houser, Miclea, & Miu, 2010). Collectively, no consistent picture emerged of how negative moods affect decision making task performance and leads to the question of whether the particular type of negative mood—or cause of said negative mood—matters.

One negative mood that has not been studied extensively in the behavioral decision-making task literature to date is anger. Individuals with high self-reported trait anger engage in greater numbers of risky behaviors (Gambetti & Giusberti, 2009; Lerner & Keltner, 2001). It is possible this is due to a change in perceptions of risk, as angry individuals report more optimistic perceptions of risk (Hemenover & Zhang, 2004; Lerner & Keltner, 2001; Lerner & Tiedens, 2006; Lerner, Gonzalez, Small, & Fischhoff, 2003). If this is the case, then we should see worse performance on behavioral decision-making tasks, as participants would not accurately detect the level of risk in their risky decisions. Studies typically induced anger with either a movie clip or an autobiographical recall task, finding that inducing anger led to both impaired/riskier (Kugler, Connolly, & Ordonez, 2012; Scheibehenne & von Helversen, 2015; Szasz, Hofmann, Heilman, & Curtiss, 2016; but only in males, Ferrer, Maclay, Litvak, & Lerner, 2017) or improved/more advantageous (Bagneux, Bollon, & Dantzer, 2012; Bagneux, Font, & Bollon, 2013) decision making on various behavioral tasks. Of note, participants in an anger induction group outperformed participants in a fear induction group on the IGT (Bagneux et al., 2013) and GDT (Bagneux, Bollon, & Dantzer, 2012). However, others found no relationship between anger and decision making (Pietruska & Armony, 2013). Thus, the relationship between anger and decision making remains unclear.

The present study sought to examine whether manipulating anger would affect subsequent risky decision making. Given the political climate during data collection (2016 U.S. presidential election), we chose to examine two methods of inducing anger: a political induction (in which participants read information contrary to their reported beliefs) and a writing prompt focused on terrorist attacks. Participants were randomly assigned to a mood induction condition (anger, political anger, fear, sadness, control), and both their current mood and performance on risky decision-making tasks were assessed. Based on the previous research, several study aims and hypotheses were addressed. First, we examined whether political issues could be used to induce anger in a lab-based setting hypothesizing that the political anger group would show higher state anger and negative mood than the control group. Next, an assessment was made on the potential relationship between anger and risky decision making. As previous research shows both positive and negative relationships between negative affect (and anger in particular) and decision making, however, no hypothesis was made as to a direction of this relationship. Also, it was hypothesized that reading contrary political viewpoints would induce a greater level of anger than writing about anger from terror attacks. Finally, we sought to examine how manipulating anger affected decision making in comparison to manipulating other negative emotions such as fear and sadness. We hypothesized that those in the anger groups would perform differently on decision making tasks than those in the fear and sadness conditions.

## Method

### Participants

Participants were 235 undergraduate students enrolled in psychology courses in which course credit was provided for involvement in research studies. Political party affiliation was as follows: 30.2% Democrat, 20.4% Republican, 18.3% Independent, 11.5% Other, and 19.6% None. Of those participants aged 18 or older during the 2016 presidential election cycle, 23.5% reported voting for a Democratic candidate and 14.0% voting for a Republican candidate. Of note, some participants completed the study prior to voting in the election, and did not indicate the candidate voted for. See *Table 1* for demographic information.

### Measures and Procedure

At the study session, all participants first provided informed consent, then were randomly assigned to one of six computerized study manipulations. In the first (Political Anger), participants read two politically-based arguments and were asked to then summarize the information. Each argument reflected the opposite viewpoint of the participant on a "hot button" issue (e.g., abortion, gun legislation, same-sex marriage, health care) that they rated as very important, which was determined based on the participant's responses to a prescreening political beliefs questionnaire developed for the present study. In the second manipulation (Anger), participants read a brief prompt regarding recent terror attacks that might have prompted the participant to feel angry. Participants were then asked to write about the feelings of anger reading the prompt might have induced. The same prompt was utilized for the third (Sadness) and fourth (Fear) manipulations. The remaining two manipulations were control conditions. Participants were asked to write about what they did before arriving at the study session (Control 1) or responded to a non-specific version of the same prompts used in the anger, fear, and sadness conditions (Control 2). Following the study manipulation, participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) and State-Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1999) to assess changes in positive and negative mood (including anger) following the manipulation.

Next, participants completed a series of risky decision-making tasks in a counterbalanced order: Balloon Analogue Risk Task (BART, Lejuez et al., 2002), Columbia Card Task (CCT, Figner et al., 2009), Game of Dice Task (GDT, Brand et al., 2005), and Iowa Gambling Task (IGT, Bechara, 2007) (see Table 2). The BART allows participants to pump a computer simulated balloon while earning $.05 for each pump which can be banked any time prior to the balloon exploding. The balloons have a random number of pumps before explosion, resulting in the retraction of all unbanked monies. During the CCT, points are allocated by turning over a series of cards. Points are either collected when the participant decides to stop turning cards over or subtracted if a loss card is turned. The number of points lost is determined by the designated amount on the loss card. Both the BART and CCT are similar, in that the greater number of balloon pumps or card turns are indicative of greater risk but also greater re-

ward. While taking part in the GDT, individuals choose to risk money by predicting the outcome of the roll of a die. Participants can choose from a set of 1-, 2-, 3-, or 4-number sequences, in which the level of risk associated with the prediction decreases with additional numbers in the sequence (i.e., 1-number is riskier than 4-numbers). The IGT allows participants to maximize their earnings by choosing cards from one of four decks. Two decks are comprised of lower risk and immediate reward but higher long term reward while the other two are higher risk and immediate reward with lower long term reward. Contrary to the BART, CCT, and GDT, the advantageous and disadvantageous card decks are learned throughout the IGT process. At the end, all participants were debriefed and course credit was assigned.

## Data Analysis

See *Table 2* for a full description of study tasks and scoring procedures. One-way ANOVAs were conducted to compare responses across mood manipulation groups on the PANAS, STAXI-2, BART, CCT, and GDT. For the IGT, a mixed ANOVA was conducted, with group assignment as the between subjects factor and block (Trials 1-40, Trials 41-100) as the within subjects factor. Of note, gender ratio varied significantly between the mood induction groups. However, performance on the decision-making tasks was not associated with gender ($ps > .330$), and thus we did not include gender as a covariate in the remaining analyses.

## Results

First, the two control groups were compared on the mood and decision-making variables. No differences emerged in responses to the mood items ($ps > .312$) or on the decision-making tasks ($ps > .206$), so the control groups were combined for the remaining analyses. No differences were found in positive mood following the mood manipulation, $F(4,230) = 1.289$, $p = .275$, but significant differences at the .05 level emerged in negative mood on the PANAS, $F(4,230) = 2.566$, $p = .039$. Participants in the anger group reported greater levels of negative mood than the political anger, $p = .045$, and combined control, $p = .042$, groups. In addition, a significant effect emerged for state anger, $F(4,227) = 2.496$, $p = .044$, but the post-hoc tests were not significant (political anger >

control, $p = .071$). No group differences emerged in trait anger, $F(4,227) = 0.681$, $p = .606$. Contrary to prediction, there were no mood group differences in performance on the BART, $F(4,212) = 0.584$, $p = .674$, CCT, $F(4,216) = 0.354$, $p = .841$, or GDT, $F(4,211) = 1.828$, $p = .125$. On the IGT, there was not a significant main effect of mood condition, $F(4,198) = 0.904$, $p = .462$, $n_p2 = .018$, nor a significant condition by block interaction, $F(4,198) = 1.248$, $p = .292$, $n_p2 = .025$. The main effect of block was significant, $F(1,198) = 4.129$, $p = .043$, $n_p2 = .020$, with performance improving from Block 1 to Block 2.

## Discussion

Taken together, minimal support was found for our hypotheses. We hypothesized that the political anger group would score higher on state anger and negative mood than the control group. In addition, we hypothesized that the political anger group would report greater anger than the anger group. No support was found for either hypothesis, as the political anger group did not differ from the control group and the anger group actually reported greater negative mood (but not anger) than the political anger group. We also found no effect of manipulated negative mood—political anger, anger, sadness, and fear—on subsequent risky decision-making task performance. While these non-significant findings are consistent with some previous research (self-reported negative mood: Buelow, 2015; Panno et al., 2013; manipulated negative mood: Heilman et al., 2010; Pietruska & Armony, 2013), they run counter to other research suggesting increasing a negative mood either improves (Bagneux et al., 2012, 2013; Buelow et al., 2013; Chou et al., 2007; Harle & Sanfey, 2007; Yuen & Lee, 2003) or impairs (de Vries et al., 2008; Ferrer et al., 2017; Kugler et al., 2012; Scheibehenne & von Helversen, 2015; Szasz et al., 2016) subsequent decision making.

It is unclear why we failed to find support for our hypotheses. It is possible that our sample of college student participants might have affected the results, as a number of participants—though eligible—did not vote in the 2016 election and may not have been as affected by the political anger manipulation. It is also possible that the context of the 2016 election might have resulted in participants who were at least partially "jaded" to politics and the manipulations used in the present study. That said, the non-political mood manipulations (anger, fear, sadness) also failed

to significantly affect subsequent decision-making task performance, which points instead in the direction that these manipulated negative moods were not sufficient to exert change in decision making processes on the tasks. It is also possible that the cause of anger might exert a greater influence on tasks than the extent of the anger. For example, previous research has utilized movie clips and autobiographical recall tasks to induce anger (e.g., Bagneux et al., 2012, 2013; Kugler et al., 2012; Szasz et al., 2016). It is possible that the more personal the manipulation of mood, the stronger the effect on decision making tasks. Future research investigating the effects of mood on decision making should manipulate multiple negative moods and utilize multiple manipulation methods, in order to investigate whether the type and cause of a negative mood matters

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## Table 1
Study variables presented as mean (standard deviation).

| Variable | Negative Mood Conditions | | | | Control Conditions | | |
| | Political Anger | Anger | Sadness | Fear | Control 1 | Control 2 | Total Control |
| --- | --- | --- | --- | --- | --- | --- | --- |
| n | 62 | 33 | 34 | 38 | 38 | 30 | 68 |
| Gender[a] (% male) | 46.7% | 21.9% | 29.0% | 25.0% | 37.8% | 51.7% | 43.9% |
| Age[b] | 18.35 (0.78) | 18.69 (1.80) | 18.25 (0.92) | 18.32 (0.66) | 18.35 (0.89) | 18.48 (1.37) | 18.41 (1.11) |
| Ethnicity[c] (%Caucasian) | 69.0% | 65.6% | 45.2% | 71.4% | 51.4% | 71.4% | 60.3% |
| PANAS-P | 2.47 (0.83) | 2.57 (0.80) | 2.34 (0.83) | 2.56 (0.85) | 2.69 (0.76) | 2.71 (0.86) | 2.70 (0.80) |
| PANAS-N | 1.61 (0.58) | 2.03 (0.81) | 1.81 (0.73) | 1.67 (0.67) | 1.56 (0.67) | 1.69 (0.77) | 1.62 (0.71) |
| STAXI-2-S | 19.84 (6.27) | 20.12 (6.74) | 19.41 (6.47) | 18.13 (4.59) | 16.92 (5.10) | 17.59 (3.49) | 17.21 (4.44) |
| STAXI-2-T | 17.26 (4.08) | 18.58 (3.61) | 17.79 (3.70) | 18.08 (4.13) | 18.08 (4.46) | 17.10 (2.97) | 17.65 (3.88) |
| BART | 22.50 (12.41) | 24.91 (12.42) | 24.43 (12.67) | 22.24 (9.88) | 20.04 (10.11) | 23.48 (11.47) | 21.65 (10.83) |
| CCT | 14.35 (5.25) | 13.84 (5.93) | 13.54 (4.96) | 14.92 (4.31) | 13.93 (4.53) | 14.82 (5.94) | 14.35 (5.22) |
| GDT | 2.23 (8.50) | 2.32 (8.33) | 4.00 (9.21) | 1.44 (9.08) | 4.59 (8.44) | 6.67 (8.67) | 5.56 (8.54) |
| IGT 1-40 | -2.76 (11.33) | -3.45 (11.65) | -4.93 (6.45) | -4.24 (9.22) | -2.63 (6.92) | -2.78 (8.57) | -2.69 (7.57) |
| IGT 41-100 | 4.00 (22.45) | -2.00 (15.80) | -4.36 (17.22) | -0.18 (22.36) | -4.44 (18.11) | 0.26 (21.89) | -2.47 (19.72) |

[a]$p = .045$
[b]$p = .628$
[c]$p = .391$

Note: PANAS = Positive and Negative Affect Schedule (average Positive and Negative subscale scores); STAE = State Trait Anger Expression Inventory (total State and Trait subscale scores); BART = Balloon Analogue Risk Task, number of average pumps per balloon adjusted for only unexploded balloons; CCT = Columbia Card Task, average selections per trial; GDT = Game of Dice Task, risky minus safe selections; IGT = Iowa Gambling Task, advantageous minus disadvantageous selections by early (trials 1-40) and later (trials 41-100) selections.

**Table 2**

Description of study tasks

| Task | Description | Study Variable |
|---|---|---|
| Balloon Analogue Risk Task (BART; Lejuez et al., 2002) | Participants blow up a series of 30 balloons, earning $0.05 per pump. The money earned on a balloon is lost if it pops before the money is banked. | Average number of pumps per balloon, adjusted for only unexploded balloons (higher values indicate riskier decision making) |
| Columbia Card Task (CCT; Figner et al., 2009) | Participants earn points by turning over a series of 32 cards (24 trials). Each trial varies the number of loss cards (1 or 3), amount to be won on each card (10 or 30 points), and amount to be lost if a loss card is chosen (250 or 750 points). | Average number of selections per trial (higher values indicate riskier decision making) |
| Game of Dice Task (GDT; Brand et al., 2005) | Participants earn money by predicting the roll of a die. They can choose a 1-, 2-, 3-, or 4-number sequence, risking $100, $200, $500, $1000 on each prediction respectively. | Advantageous (3, 4 dice) minus disadvantageous (1, 2 dice) selections (higher values indicate more advantageous decision making) |
| Iowa Gambling Task (IGT; Bechara, 2007) | Participants maximize profit by selecting 100 cards from one of four decks. Two decks are advantageous (low immediate reward, low losses, long-term gains) and two decks are disadvantageous (high immediate reward, high losses, long-term losses). Risks and benefits of the decks are learned as the task progresses. | Advantageous (C, D) minus disadvantageous (A, B) selections during the earlier (Trials 1-40) and later (Trials 41-100; Brand et al., 2008) blocks (higher values indicate more advantageous decision making |
| Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) | Participants respond to a series of 10 positive and 10 negative mood items assessing in-the-moment state mood. | Average scores were calculated separately for the positive and negative items (higher values indicate greater positive or negative mood) |
| State-Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1999) | Participants respond to a series of 57 items regarding their intensity and frequency of anger. Only state and trait items were used in the present study. | Summed total scores were calculated for the state and trait anger subscales separately (higher values indicate greater anger) |

# As if Middle School Didn't Already Suck:
# Perceptions of Disability from an Inclusive Classroom
By Madalynn Conkle

I used my sister's disability to help me get accepted into Ohio State. I used her disability to get several thousands of dollars in scholarships. My dozens of application essays center around the idea that my younger sister's dyslexia contributed to my worthiness to earn an award. In fact, one of the 2015 Common Application essay prompts was "Discuss an accomplishment or event, formal or informal, that marked your transition from childhood to adulthood within your culture, community, or family." I said my "accomplishment" was helping my sister learn to like reading, which contributed to my growth from childhood to adulthood.

My narrative essay applied a disability narrative trope all too well: that people with disabilities are merely plot devices to help develop the characters of people without disabilities; that disabled people serve as a sort of muse and bring a realization to non-disabled people.[1] Or, as I wrote in 2015, they give nondisabled people new "eagerness to help, understanding, and patience."

Regardless of whether or not using my sister's disability as essay content was right, the fact is that disability affects nondisabled people. The effects my sister's learning disability has on me compels me to look more closely into the relationship between students with disability and those without. Specifically, I ask, how does the socialization of students without disability and students with learning disabilities within a mainstream, public, middle-school class setting influence nondisabled students' perceptions of disability?[2]

Based on my personal experience with disability—encountering it at a young age via my younger sister—my general hypothesis for this question is that inclusive education settings encourage empathy-building among nondisabled students and improve social intelligence or lessen isolation within disabled students.[3] This prediction is reasonable because, as studies indicate, by interacting with disabled peers, nondisabled students learn tolerance and appreciation for people with disabilities (Evins, 2015). The more we interact with an "other" group, the more we come to understand and empathize with them. The increasingly common practice in public schools is to integrate students with and without disabilities. Research describes such inclusion as an effective way to promote nondiscriminatory and open education for all students. Furthermore, interaction between disabled and nondisabled peers increases overall social functioning for each group (Martinez, 2006). Inclusive classrooms have the potential to improve social and emotional welfare throughout both disabled and nondisabled groups.

Despite the aforementioned praises toward inclusive classrooms, other studies show that putting students with learning disabilities into a mainstream classroom brings additional difficulties to these students. Pavri and Luftig (2001) cite studies that found nondisabled students and teachers in inclusive classrooms do not accept disabled students, oftentimes ignoring or actively rejecting them—thus supporting the idea that people with disabilities are less desirable than those without disabilities. This shows a lack of increased empathy in nondisabled students toward their disabled peers.

The most common group studied in research regarding classroom inclusion is the middle school age group—a population of students that has relatively distinct social norms. Unlike elementary-aged students, young adolescents have relatively accurate social competence. Also, these students typically depend highly upon their peers for support. As it is widely—and oftentimes humorously—addressed, middle school is rough. In general,

students face the pressures of trying to "fit in" and find close friend groups. Martinez (2006), however, suggests that students with multiple learning disabilities may perceive greater distancing during these middle school years, even in an inclusive setting.

With the increased social competence of nondisabled students, "passing," as Cox (2013) says, in this setting becomes increasingly difficult for students with disabilities. For "passing as sane" depends on others' interpretations of a person's embodiment; when those interpretations change, a person must adapt to avoid the high social costs of not passing. Moreover, as nondisabled students increase their social competence, the visibility of invisible disabilities, such as learning disabilities, increases. An increase in visibility does not, however, mean that the nondisabled population's understanding of the disability—or knowledge that a person's unorthodox behavior is due to a disability—increases.

None of the cited studies state whether or not nondisabled students were actually aware that their disabled classmates had disabilities. Research only indicated that nondisabled students perceived disabled students as aggressive, disruptive or of low social status. Interestingly, no studies showed that nondisabled students felt pity toward disabled students, which could be due to the students with disabilities being relatively high-functioning. Knowing to what extent nondisabled students have knowledge of their peers' disabilities could give greater insight into how inclusive classrooms impact nondisabled students' perception of disability. As inclusive classes are more beneficial to the developmental growth of higher-functioning disabled students than they are for lower-functioning disabled students, it is realistic to assume that most students without disabilities may not consider their disabled classmates as being disabled (Evins, 2015). Instead, nondisabled students would label students with disabilities as simply disruptive or weird and therefore prompt social separation between disabled and nondisabled students despite being together in a classroom. The assumption that middle school students are not aware of their classmates with learning disabilities reflects Kleege's (2015) point that "People with invisible impairments often are excluded from the general public's collective image of disability" (p. 184). The ambiguity of to what extent students without disability have knowledge of disabled students and their disabilities means that we are limited in accurately understanding how interact-

ing with disabled students affects nondisabled students' perception of disability.

What is indisputable is that inclusive classrooms ensure that students without disabilities do have some sort of relation with students with disabilities. Cox (2013) addresses how performativity theorists argue that our sense of self is created by repeated and ritualized actions and that these actions occur through our relations. Because inclusive classrooms put nondisabled students into acting in relation to their disabled peers, nondisabled students' performativity—thus, their sense of self—is partly defined by their actions with disabled students. In an environment that promotes equity and understanding for each student, nondisabled students may gain increased empathy through their relations with disabled students. But in an environment that does not reassess expectations of students and stigmatizes invisible disabilities, nondisabled students may view disability as negative and a burden to both individuals and groups.

Understanding classroom dynamics between students with and without disabilities, while considering the academic and social implications of learning environments, will improve educators' approaches to student groups with different abilities. Furthermore, applying this knowledge will help guide disabled students transitioning from one learning or social environment to another: elementary school to middle school, middle school to high school, and high school to college. For instance, after years of practicing, my sister now enjoys reading; but as she went from grade to grade, other learning and social barriers became more prevalent. She no longer holds close relationships with her peers, instead opting to socialize with adults or young children for whom it's easier for her to "pass." Reassessing norms in educational environments, which are decided by the nondisabled, will relieve social pressure on disabled students, thus improving their academic and social welfare. Finally, evolving mainstream education norms will ultimately affect realms outside of the classroom: employers, coaches, instructors for higher education, and other people working with diverse stakeholders will better understand group dynamics to make more opportunities accessible to all.

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# An Affordable, Autonomous, Solar Powered and Modular Robotic Water Monitoring System

By Raghav Samavedam, Jayanth Gunda, and Ryan Ziegler

## Introduction

Ohio is no stranger to water quality problems, with some of them garnering national and international attention. In 2011, Lake Erie, which borders 4 U.S. states and Ontario, Canada, had a record setting algal bloom that covered 2000 square miles, three times larger than any other previously observed [1], [2]. This phenomena, Cyanobacterial Harmful Algal Bloom (CyanoHAB), primarily occurs due to excessive nutrient presence from agricultural fertilizer and urban runoff, as well as improper wastewater discharge [1]– [3].

In the case of the 2011 bloom, unusually high water temperatures and phosphorus levels - the latter likely caused by fertilizer runoff from northern Ohio farms - combined to nurture and grow the algal population in the lake [4]. When this algal population grows to a critical mass, its toxin release can negatively impact humans and animals drinking this contaminated water by causing skin irritation. Other problems, including respiratory, gastrointestinal and neurological problems, are particularly dangerous to certain high risk groups such as people with chronic diseases, children, and the elderly [5].

Furthermore, algal bloom growth and its subsequent decomposition depletes the water body of dissolved oxygen, resulting in a higher death rate for fish and other aquatic organisms. Though this problem had its roots in northern Ohio, toxic CyanoHABs have been implicated in human illness and death in 43 states nationwide [3].

Local pond health is also a subject of concern regarding water quality in Ohio. In July of 2018, Governor John Kasich signed an executive order declaring eight major watersheds in Ohio as distressed in order to target runoff from agricultural fertilizer applications. Municipal wastewater effluent has also been cited as a threat to local pond health. It has been termed as inadequately treated sludge discharged into the environment. Moreover, this effluent may contain organic emerging contaminants such as pharmaceuticals, illicit drugs and personal care products, which in turn could lead to endocrine disruption in local wildlife. Petrie et. al. [6] notes that these problems are hard to monitor citing that "[d]uring wastewater treatment, there is a lack of suspended particulate matter analysis due to further preparation requirements and a lack of good analytical approaches."

And in the context of private ponds, Pennsylvania State University [7] found that most pond owners have never tested their ponds, and water quality problems are usually only detected after they cause a problem.

Both problems - algal blooms in large lakes and sewage effluent discharge in small water bodies - can be mitigated with effective water monitoring techniques [3], [8], [9]. Real-time information on water quality is very important for predicting major pollution problems in lakes and directing active management of the issue so as to ensure our water resources long-term availability [8].

However, Contemporary water monitoring has its own set of complex issues. Most water quality issues arise from diffuse non-point sources like agricultural runoff from farms and animal feeding lots, the same type of pollution that is widely believed to cause CyanoHABs in Lake Erie. Compared to contaminants that come directly from point sources (e.g. effluent discharge from one sewage treatment center), agricultural runoff is harder to monitor, evaluate, and control primarily due to the fact that the emission of pollutants

from a non-point source is highly variable along short periods of time. With considerable variation even on an hourly basis, single measurements are not able to characterize the water quality and quantify pollution levels over time. Thus, frequent samples in multiple areas are needed for accurate representations and models of water-body pollution.

It is here that we see the drawbacks of current water monitoring systems. Standard water quality testing options are generally heavily reliant on human fieldwork to gather test samples and ex-situ lab testing. Frequent sampling at multiple areas becomes a massive logistical and financial problem due to the human factor involved and the need to send samples to off-site laboratories for further processing introduces a considerable time delay. For these reasons, standard methods fail in helping to monitor, evaluate and model non-point sources of pollution in real time.

Current research has tried to address these shortcomings. Solar-powered buoys have been created that contain water monitoring sensors for temperature and dissolved oxygen among other factors. To combat the fact that buoys are stationary, mobile remotely-controlled boats with similar sensors have also been developed that are able to operate for short periods as opposed to continuous, long-duration deployment. However, these systems are expensive, costing about USD 6,000 - 7,000 for the buoys and USD 30,000 for other stationary, automated water monitoring systems.

In this project, we seek to expand on the work of Dunbabin et. al. from the University of Queensland [10] and create an affordable solar powered autonomous raft for water monitoring of non-point and point sources of pollution. We stress affordability by building our robot with components one can easily find in a hardware store all for under USD 1,500 by using a design that is modular and makes the robot easy to transport and service.

In what is a clean break from past research, we focus on ensuring our water-monitoring system can innovatively communicate its results by building a web client to visualize our collected data and developing a natural language parser interface so that users of all educational levels can intelligently query for specific pollution details.

We also lay out a framework for predictive analysis of our data and future plans of study involving dynamic water treatment.

The following concepts detail the important terminology and framework, in the context of our research, to be used to the experiment:

**Design and Development**

With water crises in places all over the United States, from the foothills of Appalachia to the urban spaces of Compton, California, there is a need not only for reliable water monitoring but also for an affordable system that cash-strapped municipalities can afford. Thus, in creating this water monitoring system, we have stressed cost-affordability and usability as our mobile water monitoring system costs under USD 1,500 compared to other stationary systems that start around USD 5,000 and require human fieldwork which is economically infeasible for providing enough number of data points over long periods of time.

As water monitoring devices are expensive, we wanted to keep the main design of the autonomous robotic device as modular and inexpensive as possible. For our flotation devices, we used two sealed high density polyethylene pipes as they are biodegradable and relatively inexpensive. Through calculations on the displacement of the flotation devices, we determined that the upper limit on the mass of the robotic device was about 25 pounds or 11.4 kilograms - this meant that we could carry an additional 8 pound (3.6 kilograms) payload that could be used to do additional testing.

This weight load is possible as the raft is formed with lightweight aluminum extrusion rods joined together using L-brackets and stainless steel screws and nuts which are all available at most hardware stores.

For propulsion, the robotic device used two 22 Watt hexagonal-shaft motors, each connected directly via shaft to a custom-designed, 3D printed paddle wheel comparable or cheaper in cost to other alternatives in the market. The motors were controlled by an affordable, multi-interface hardware controller connected to a smartphone, which had GPS capabilities for autonomous navigation and cellular capabilities for data upload and manual control.

(See Figure 1 for Robot Design in Action)

In order to maximize uptime and reduce the need for human intervention to do charging, a 50 Watt solar panel is attached to the top of the robotic raft for powering the onboard electronics and motors. We initially researched a tilt mount to maximize solar output.

However, we ultimately decided against this due to stability concerns and the need for the robotic device to be oriented such that the panel faced true south at all times. For regulating and storing energy created by the panel, the robot device uses a charge controller and 200-watt hour lithium- phosphate battery. Although the parts that form the solar power system (panel, charge controller and battery) are the most expensive components of the robotic raft, they add critical functionality for the robot to have long-term use (See Solar Panel, Power and Battery Considerations for more information).

Existing water monitoring systems derive most of their cost from their sensors and sample testing, so in our goal to develop an affordable water monitoring solution we focused on adding water sensors that could give good all-around insight into the environment but still be inexpensive cost-wise. In its current configuration, the autonomous robotic device uses a modified fish tank sensor that is able to detect ammonia, pH, water temperature and light intensity (See Systems Applications to Environmental Problems for further environmental insight said parameters can give). This sensor is able to measure free ammonia through detecting the degree of color change in a specially designed slide that is periodically exposed to the surrounding water. The readings are reliably accurate and though the slide needs to be replaced every month or so, it is relatively inexpensive - costing about 10 USD at the time.
The readings from the sensor are extracted and uploaded by a Raspberry Pi micro-computer (See Data Management and Access for more details) which can theoretically interface with any sensor that has a USB connector, making the robotic device modular and allowing for future sensors to be added to analyze the lake (See Figure 2).

**Autonomous Navigation**

The system is equipped with two Motorola G5 Plus Android phones: One on the robotic raft, and one with the client operator. These phones are connected through single radio hop Wi-Fi Direct communication, which allows wireless connection to be established without the need of a wireless access point. This dependency allows the usage of Global Positioning System Location Tracking on the onboard phone to obtain the Latitude and Longitude coordinates of the robot position. The compass sensor capability of Android is also employed by using the pre-built phone magnetometer to return compass readings that determine orientation.

The autonomous navigation algorithm uses the dimensions of a given water body to generate waypoints that provide a maximum traversal of the area. This provides sufficient sampling variability to eventually yield the most complete picture of the water quality that can be used for further analysis. The waypoints are placed in an order relative to the initial robot position, and their positions are used to divide the lake into various attention sub-regions (Fernandes et al) [11]. Next, a minimum length tour i.e., the shortest overall path that allows the robot to cover each region, is constructed (Branson et al) [12]. A segmented sequence is created with the ends of each segment corresponding to the relative waypoint order. For each segment, its length and its angle measurement (assuming the standard Cartesian coordinate plane) are calculated. The algorithm then makes use of the encoder capability of the raft motors, which generate a specified number of electrical signals for every rotation of the paddle wheel. A one-to-one correspondence is thus established between the distance and the encoder ratio to determine the number of paddle revolutions, and its corresponding encoder value needed to reach the waypoint destination. This allows the robot to move freely and with minimal interference.

Proportional-Integral-Derivative Control, a control-loop feedback mechanism system, is also used to tune an optimal motor speed consistent with the encoder readings (Pereira) [13]. This creates a navigation system independent of battery life to generate the maximum positional accuracy. Finally, the prior calculated angle is transformed into a yaw rotational value that the robot needs to obtain to be able to move exactly along the line segment. During travel, the GPS coordinates of the current robot position are compared with the end waypoint to act as a calibration check system (Burgard et al) [14]. Based on the real-time encoder count value, the true GPS position that preserves the correction direction (along the line segment) and orientation (same as initial angle) is calculated. This is then compared to the actual data values, and the robot is made to move accordingly until the margin of error reaches an acceptable tolerance level.
(See Figure 4 for Generated Path Example)

## Implementation of PD Course Correction Control

To ensure that our robot, in its autonomous operation, stays on course as it moves from target to target, we have implemented a form of PD (Proportional-Integral-Derivative) Control System.

First, before navigation truly begins, the robot, using a GPS Location Service, is able to extract the latitude and longitude of its starting position (known as initial position in the data section). Then, a timer is started to eventually calculate velocity (detailed below). Next, based on the latitude and longitude of its target position, a straight line path (hypotenuse) is drawn from the initial to target, and the corresponding azimuth angle (0 Degrees being North, and rotating counter-clockwise) is calculated based on the trigonometry of the right angled triangle. The robot takes its own azimuth (obtained through the magnetic sensor of the on-board Android Phone), and rotates until it reaches the desired azimuth of the path, plus or minus a threshold of 5 degrees (PI/36 Radians).

Next, the robot sets both of its motors to a power of 0.25, and continues straight along the specified path. This is where the PD Course Correction comes into play. We track two locations: Previous Location which is the latitude and longitude of the robot before the GPS gives an update, and Current Location: The most accurate location of the robot after the update from the GPS Location service. Initially, Previous Location and Current Location are the same, since the GPS Measurements have not changed.

Once the location gets updated by the GPS, Previous Location is no longer equal to Current Location. At this point, we calculate two things for our PD Algorithm. First, we calculate the length of the perpendicular distance from the robot's most updated position to the straight line hypotenuse connecting the initial position to the final position (initially calculated from the first rotation). This is accomplished using trigonometry and vector projections, as shown in Figure 8. Also, as soon as the location is updated, the timer that we set in the original rotation is stopped, and the velocity vector of the robot motion is calculated using the displacement vector and the elapsed time. Using the same principles of trigonometry as before, the orthogonal velocity (velocity in the direction of the original path) is also calculated.

These two metrics combined tell the robot how much to rotate, and in what direction, to get back on track to the original created path. The distance and orthogonal velocity values calculated are linearly combined with P and D coefficients (tuned by Experimental Testing) to give a total angle of rotation: Total = P * Distance + D * Orthogonal Velocity (P: Proportional to Error, which in this case is the distance to the original path, D: Derivative: Rate of Change of Error, which in this case is how fast the robot is deviating away from the path, i.e., the velocity). Roughly, the Distance will tell us how much of a numerical angle to turn, and the Velocity's Direction/Magnitude will help us to control overshoots/undershoots in this rotation.

After this control, the robot gets back on course, and continues in the straight line path again, until the next time the GPS Updates. At that point, the PD will take effect again for course correction. This process will continue until the final target has been reached.

What follows is a tabulation and graphical representation of the autonomous navigation algorithm ()., First, the GPS location of each waypoint is recorded, and for each successive destination pair, the needed angle rotation, and length of travel path are also calculated. (See Table 1)

Next, the periodic check value is documented and compared it to the actual robot position. (See Table 2)

Finally, the appropriate numerical values are graphically represented on the coordinate axes, which are superimposed onto the region of detection. (See Figure 4)

## Computer Vision

To ensure the avoidance of all obstacles during robot motion, autonomous navigation is supplemented with a Computer Vision Algorithm, which runs using the Open Source Computer Vision Library. The development of the algorithm followed two main steps: Image and Real-Time Video Detection.

The first focus was on tracking various types of static images to help us to identify the most pertinent features that are needed for a comprehensive object understanding. Images chosen were applicable to the robot's scenario, and included boats, wild animals, bunched seaweed, etc. Implementing the Mat Container feature of OpenCV, allowed for obtaining access to the raw image pixelation data, and used the resulting

numerical values as a precedence order for detail prioritization (Baksheev et al) [15]. This led to a narrowing down on four basic key factors: Degree Presence of each of the 7 main colors (White, Red, Green, Blue, Yellow, Brown, and Black, plus any combined shades), concentration of the edge pixels on the object boundary, length of the substance (estimated using the spanned distance of the best geometric figure approximation), and the standard deviation error of the generated shape to the actual physical quantity in the horizontal and vertical directions (Bloisi et al) [16].

Next, the process of detection itself was tuned to apply to a traversal of a lake. Standardizing the images using RGB-Grayscale conversion ensured that the system was illumination-independent (Emami) [17]. As such, the issue of limitation of sample collection to daylight hours was bypassed.

In addition, the software also included the ability to approximate the edges of imperfect instances of objects. This is accomplished through the Hough Transform, which uses a parametric coordinate system to output a best-fit edge curve based on read physical properties (Barngrover) [18]. Through this overestimation, a tolerance level is generated for the raft navigation that provides ample room for maneuverability. After laying out this preparatory groundwork, the process transitions to video. From the OpenCV GPU module, the Android mobile device on the robot becomes capable of stabilizing streaming video and breaking the reception down into an individual frame-by-frame sequence. The same metrics from the images are employed in the video analysis by essentially taking each frame as its own separate quantity. The phone is positioned per a landscape orientation and installed at the front of the robot to maximize the viewing range of its inbuilt camera. Whenever a pressing obstacle, in terms of size and threat level, is detected, the robot stops and begins a counterclockwise rotation until the algorithm deems its orientation as safe to proceed.

In the future, we plan to use techniques from Mathematical Morphology and dilate specific goal pixels to continue to enhance accuracy (Lu and Xie) [19].
(See Figure 7)

**Solar Panel, Power and Battery Considerations**

Our robotic device uses a 200 Watt Hour Lithium Phosphate battery for storing energy from the 50-watt solar panel, as this battery is significantly lighter than lead acid batteries, has a high number of charge cycles, is non-toxic unlike Lithium-ion or lead acid batteries and less flammable than Lithium-ion batteries. With an estimated 5,000 charge cycles the battery would last about 10 years, making it a durable, sustainable and environmentally friendly option.

Based off of conservative estimates, we calculated that the robotic device would have an instantaneous 50 Watt power draw when moving. So, in choosing battery sizing, we computed that a 200 Watt Hour battery would give enough energy for the robot to move intermittently through the day.

Based on size and weight limitations, a 50 Watt solar panel was integrated into the design with an assumed 6 hours of sunlight a day during monitorable months. Because the robotic device has low amperage draw, the solar panel is connected to the battery via a 30 ampere Pulse Width Modulation (PWM) charge controller to ensure optimum performance at lower cost. The PWM charge controller can power a USB device and the battery, giving added flexibility. Since all the loads are DC powered and can be directly powered by the battery, there is no need for an inverter.

The charge controller can also be fitted with a Bluetooth module in the future to monitor the energy output from the solar panel for educational purposes.

**Data Management and Access**

In order to effectively collect and act on data from the autonomous robotic device, data must be exchanged between it and the servers. The autonomous robotic device is equipped with a Raspberry Pi, a small computer running a Linux-based operating system. The Raspberry Pi contains a variety of General Purpose Input Output pins, four USB ports, and an RJ45 port to interface with the USB-connected water sensor. The script utilizes the Message Queue Telemetry Transport (MQTT) protocol to send data to the server at frequent intervals. MQTT is a lightweight transport protocol for Internet of Things (IoT) devices to stream data to a server. RabbitMQ converts MQTT messages into Advanced Message Queueing Protocol (AMQP) messages. A service written using JavaScript reads messages from the alert queue, and determines if they match alert thresholds for pollution, as defined by the users. When

a threshold is met, the alert service sends an email to the associated email account. Another service, also written in JavaScript, reads messages from the processing queue and writes them to a database. In addition, as it is essential for researchers and the general public to easily access water pollution data, we also developed an innovative web client interface for communicating collected data. To visualize the data, a heat map displays pollution statistics made up of pH, temperature, and ammonia levels. The user can utilize a slider to see historical pollution levels and trends.
(See Figure 2)

By using multiple services, alerts can be sent at the same time data is being saved, removing a bottleneck present when several devices report statistics at once.
(See Figure 3)
Additionally, users can obtain point data using a Natural Language Processing (NLP) interface. The user can type in a question about specific pollution factors, and the NLP system will process the request and find relevant data for the user. The language processing system extracts keywords, for example temperature, and then analyzes temperature data for the date(s) provided to return data to the user. If a user does not provide a date or time, the parser can extract keywords that indicate tense and relative date (what will be, what was) to determine the date(s) to query for. And lastly, if a user does not indicate a specific pollution factor in their query and instead asks about general water quality, the parser will return a water quality score determined by internal calculations on the central tendency of the pollution metrics being measured.
(See Figure 5)
Both the heat map and NLP interface use a Representational State Transfer (REST) interface to communicate with and obtain data from the servers. Gaining composite data is useful, but is no substitute for raw data, especially for research applications. In the near future, researchers will be able visit a dedicated research portal and request to download data. The portal uses the same REST interface as the heat map to retrieve data. Researchers will simply check boxes to select which data to access, and upon submission of a request, a retrieval service will email researches data. By using a standardized REST interface, researches can also directly query for data instead of using a portal, opening further expansion opportunities.

With these interfaces, our water monitoring system can also have applications in environmental education. Students can learn about water pollution, and apply water pollution concepts to our web application to complete projects. For example, students could use heat maps combined with statistics extracted via NLP to explain algal blooms and detect areas with potential sewage contamination.

Ensuring reliable access to data is a requirement for significant research to be performed. As such, we have taken a multi-cloud approach to reliability. Microsoft Azure is our primary cloud provider. Microsoft Azure is an automatable, secure, and reliable cloud platform with data centers across the United States retrieving services that run on a Kubernetes cluster. Kubernetes is a server and cluster orchestration tool which enables us to easily deploy and scale applications across multiple servers with auto-scaling rules. The cluster will automatically run the number of services required to meet current demand. However, in the event of failure in Microsoft Azure, we have an identical Kubernetes cluster running on Amazon Web Services (AWS). Devices will automatically send data to AWS if Azure is unreachable, ensuring valuable data is not lost.

## Research Methods

The methods conducted for our two separate experiments are detailed as follows:

### Computer Vision

i) Accuracy
To test the accuracy of the Open-CV algorithm (specifics of which are detailed in the introduction), ten images (See images 8 to 18 in the Figures document) were selected that pertain to possible scenarios that our robot could encounter during its time in the body of water, such as rocks, debris, animals, etc. Each image was placed a constant distance of 8 inches in front of the onboard robot camera. For each trial, the maximum size of the dimensions of the pixel rectangle created by the detection system was recorded. Variations within the generated sizes were noted, as well as any failures/irregularities in the detection. Note that, sometimes, the goal is for the robot to fail in the rec-

ognition of a specified object. Consider the example of lily-pads. In a given lake, there could be numerous lily-pads, ranging from the single to double and even triple digits. It is not worthwhile for the robot to detect and turn away from these plants at every possible opportunity, as it will reduce efficiency in motion. The best option is for the robot to continue along its path since contact with lily-pads will not harm its mechanical structure. Our selected images also encompass this aspect of detection. If there is a huge deviation for any of the image results from trial to trial, a brief explanation is written to explain why this might have been the case.

ii) Orientation

To test the ability of the robot to modify its orientation, the same ten images used in the accuracy test (See images 8 to 18 in the Figures document) are placed in front of the onboard robot camera (through the Moto g5 Plus Android Phone), at a constant 8 inches away. For each image, three metrics are recorded as part of our data. First, a stopwatch is set as soon as the Computer Vision Detection Program is initialized, and the time taken for the phone to output a reading detailing the object (either the dimensions of a pixel size rectangle or a failure to recognize) is recorded. Next the motion of the robot based on the initial detection in step 1 is noted. After each detection, the robot can enter two possible states: It can either go from two wheels spinning to only one, which implies that it is has deemed the detected object as a harm and is turning away from it, or it retains the state of two wheels spinning, which implies that it is going along its current path after having deemed the object a non-hazard to motion. Finally, after this second step, it is documented whether or not the robot action was appropriate given the circumstances presented by the image. For example, if the image was of rocks in the water, the desired motion is to turn to ensure that there are no crashes. However, if the image was of shrubs in water, there is no need for the robot to rotate, and it can continue going forward on its straight path. All of these values are recorded, and brief explanations are given for any irregularities.

**PD Course Correction Control**

The intent of the PD Algorithm is for the robot to accurately move from an initial location to a specified

target location, which is dependent on the concentration of pollutants in the water. To do this, the robot first starts in an initial position, rotates until it reaches the angle corresponding to the target position (Based on the azimuth reading of the Moto G5 Magnetometer sensor Android Phone). Then, it continues along this straight path. Every time the location updates on the GPS, a 'Turn by PD' function is executed to ensure that the robot re-orients itself to align on the initially calculated path. In this experiment, it is sought to test the accuracy of this function.

A land-based test was chosen for this experiment as it allows more control in robot positioning and data collection. Three initial locations were chosen, with a constant final location for each trial. For each location, we ran exactly one iteration of the PD Course Correction, occurring when the GPS first updated on the Android Phone. During the PD Turn, the change in the azimuth heading of the robot (that is, its orientation) is recorded, as well as the length of the perpendicular vector that separates the initial correct trajectory of the robot (calculated right after the autonomous program is initialized) and the robot's deviated trajectory obtained in the time intervals between location updates. The angle of separation between these two directions is also calculated and displayed in our data table. Finally, after the PD modification has run its course, the total displacement of the robot, from the initial position to the location that the robot's most current position just after the PD Control, is calculated and expressed as a matrix containing both the latitude and longitude components. And, this updated location is also placed in the table as a latitude and longitude pairing. See Figure 8 for a graphical visualization of this course correction experiment.

The objective of this experiment was to be able to numerically quantify all of the values associated with our PD Control (See diagram in the images section regarding PD vectors/angles). And, based on the data gathered, a conclusion can be made as to whether or not our algorithm was accurate enough to ensure constant travel along the correctly calculated path (See results/conclusion section).

## Results

See the separate figures document for specific data values tabulated over the course of the experiment. (Specifically, Tables 3, 4, and 5)

### Computer Vision Accuracy

Overall, we see that our OpenCV detection software was accurate 44 times out of 50 total trials (5 attempts for each image, with 10 images in total). This is an accuracy rate of 88 percent, and is ideal for the testing stage of our robot development. It is also almost ready for on-field usage in the water. The few discrepancies in recognition were either caused by over-saturation of color in the RGB to Grayscale conversion, or distortion caused by the reflection of sunlight rays onto the water, which modified the coloration values as perceived by the vision. To rectify this, the coloration algorithm needs to be modified slightly to account for the cases where extreme shades of color are present. In addition, the orientation of the camera needs to be angled slightly upward so that there is no longer interference by the waves in the water in influencing the robot's decision making.

### Computer Vision Orientation

For the ten images put to test the robot's decision making ability, it performed the appropriate action (i.e., turning away for the object or going along the intended path) a total of 9 times out of 10. This is an accuracy rate of 90 percent, slightly better than the accuracy test, and still ideal for the testing stage of our robot development. The one error in motion came from the robot on-board camera focusing on another prominent color, that of the vibrant water waves, as opposed to the sharks, fish, and whales that were somewhat blending in with the water. As such, the CV only identified the presence of water and failed to recognize the aquatic life altogether. To rectify this in the future, we need to modify the algorithm in the cases where the object is fully or partially submerged in the water, so that the coloration process can account for the effect of the color of the water somewhat masking the color of the objects.

### PD Course Control

It can clearly be seen that, in all three cases of the angle modification, the azimuth heading was correctly changed to a value that aligned with the initial created path, with minimal error. No matter how much deviation was done on the robot's path through manual displacement and rotation, the angle change was correctly able to be made, allowing the robot to continue on the correct path to reach the target position. In the first trial, it was noticed that the tested P and D coefficients (initially P = 1000, D = 1000) had room for some improvement. While the robot was able to move to the general direction of motion through the course correction, since the two coefficients were quite large, the robot would quickly rotate to be within the threshold specified in our code and not slow down enough as it neared the required azimuth, leading to an accurate, but not precise, turn. To rectify this minor issue, in the second and third trials, the P and D values were lowered, finally settling on P = 891, and D = 928. This gave us, based on the visual observation, the most accurate motion corrections.

## Conclusion and suggestions for future research

### Conclusion

The conclusion that can be made from this experiment is that our robot is a viable alternative to existing water monitoring systems, in terms of affordability, autonomous control and ease of navigation, and accuracy and precision in data control. Going forward, the aim is to expand upon our system and make it fully robust in all three stages of the process: autonomous navigation, data collection, and server transmission.

### System's Applications to Environmental Problems

a)      Point Sources

This system has potential for monitoring and evaluating point sources of pollution through its many on-board sensors. Current detection systems are stationary and therefore require an expensive group of sensors to obtain a metric for the entire lake quality from just one sample region. Our robot uses only one main sensor package with the ability to detect multiple contami-

nants at once. Due to its mobility, there is no need to use a network of many sensors as our robotic device is able to relocate this package to many points of a water body on time-scheduled intervals. This results in ease of deployment and allows regulatory agencies to make impromptu, discreet checks on suspects of point-source pollution Moreover, the water quality of the entire body is determined at a much more affordable rate.

Since our robotic device contains a pH sensor, it is possible to detect pollution from improperly managed mining areas by testing a nearby water body for unusually low pH (acidic) levels. At the other extreme, high pH levels can indicate that there is wastewater contamination that contains detergents, soaps and other toxic chemicals.

In areas with negligible agricultural and municipal runoff, the presence of ammonia and other nitrogenous compounds is also a strong indicator of sewage contamination as sewage treatment centers do not remove urea, which later decomposes into ammonia, from wastewater.

This added ability to do wastewater detection gives our water monitoring system an extra dimension in early warning and detection of cyber-terrorism as water treatment centers have been listed as prime targets of cyber-terrorism by the United States Environmental Protection Agency due to the fact that an unauthorized discharge of untreated sludge could cause catastrophic change to our water resources.

b) Non-Point Sources

As mentioned before, non-point sources have variation in their emission of pollutants over time which makes it relatively hard to quantify and evaluate their impact on the surrounding environment with current methods involving one-time monitoring. Non-point sources are also diffuse and non-homogeneous, making standard methodologies that use a network of floating sensor stations economically impractical over large areas.

The water monitoring system put forth is able to solve these problems of infrequent sampling on large test areas as it contains only one continuously reporting sensor package that can migrate around to multiple user-specified testing points in a water body. Thus, there is less overhead due to the fact that there is no need to set up multiple different testing sites and there is added ability to do continuous water monitoring over long periods of time, a trait considered critical for future water monitoring systems. This additional flexibility to quantify non-point sources allows our water monitoring system to tackle pertinent problems in water quality.

Problems in the Great Lakes such as CyanoHABs, which are nurtured by warm water and nutrients from agricultural runoff, can be effectively modelled through use of the onboard temperature and ammonia sensors (refer to concepts of affordability). Ammonia is especially useful in detecting nutrient runoff as most nitrogen-based fertilizers either contain ammonia or turn into ammonia through the nitrogen cycle and most phosphate-based fertilizers consist of di-ammonium phosphate which breaks down into phosphate and ammonia after being released.

Not only as a cause for CyanoHABs, non-point pollution such as nutrient runoff is also a dominant problem for local watersheds [20]. The United States Environmental Protection Agency (USEPA) has for the past several decades' ranked nutrient pollution as one of the top threats to U.S. streams and the United States Geographical Survey (USGS) has prioritized comprehensive national studies to assess nitrogen and phosphorus content in local streams and groundwater [21].

With major focus on national-scale water issues such as Great Lakes algal blooms, important local water issues may be overlooked. As our water monitoring system is affordable, costing under USD 1,500 and requiring no technical background to deploy, local municipalities may find this a useful technology for monitoring diffuse and potentially harmful runoff into their water bodies and sources.

c) Public Health and Early Warning System Potential

The data our robotic device collects is suitable for determining public health considerations as the pollution factors the robotic devices sensor can detect - pH, ammonia and water temperature - are useful in gauging environmental health. Any extrema in their values would indicate dangerous consequences for human and wildlife health with at-risk groups such as children, pregnant women, people with chronic disease and the elderly being especially susceptible.

pH is important as fish and other marine biota have a very specific pH tolerance - low pH inhibits shell growth, fertility and at very low levels can cause fish

death. Similarly, on the other side of the scale, higher pH (i.e. basic) water can result in skin and gill issues and fish death in the presence of ammonia.

Ammonia, as well as other forms of nitrogen, in high levels can cause harm to the environment by acidifying the soil and decreasing biodiversity. Ammonia is also dangerous to pregnant women and children and with prolonged exposure can cause burning of the eyes, ears, throat, and lungs.

Extreme values in temperature are detrimental to fish as certain species have very specific tolerance levels. In general, warmer water from runoff reduces dissolved oxygen in the water body which results in reduced growth, excessive respiration rates, and lower survival rates in fish population. For communities that rely on fishing as a source of recreation, income, or both, extreme water temperatures are thus problematic.

And with crises like the Flint Water Crisis garnering national attention, there is clearly a need not only for public health testing of the pollution parameters described above, but also for reliable early warning systems. For any early warning system to work, continuous monitoring of the local water bodies must be done. The water monitoring system we have put forth has this capability due to the autonomous robotic device being solar powered, resulting in minimal downtime for charging or refueling.

Communication of data is also a critical feature of early warning systems. This is where the water monitoring systems web client is particularly useful, as its natural language parser and interactive heat maps are useful not only for environmental education but also for members of the general public who want intuitive, up-to-date information about local water quality.

By combining the current web client with text-message warnings from the server, our water monitoring system would be able to communicate real time water quality data to the public in an innovative way.

## Future Research Plans

Once enough data has been collected, we plan to do time series analysis on our collected data to identify three predictive metrics for each collected pollution factor: long term trends, daily forecasts, and seasonal patterns. For the long term-trends, we would employ a linear regression model through a Least Squares Regression Line to maximize accuracy. For both the daily fore-casts and seasonal patterns, we would use a Fourier Series to represent the data. The Fast Fourier Transform would allow us to extract the sinusoidal waveforms of our measured metrics. Taking the high-frequency signals, we could determine short-term, daily patterns. Similarly, we would use the low-frequency signals for seasonal to yearly changes. Furthermore, we plan to extrapolate any trends we would discover from our model and use them to predict future conditions, adding extra functionality to an early warning system.

We also have plans to expand our water monitoring system to include dynamic water treatment through automated floating beds of beneficial native Ohio wetland plant species. These species are known for their ability to absorb excessive nutrients such as phosphates, nitrates and iron from a water body. A researcher from Ontario, Canada, has developed floating beds which contain rows of cattails with their roots exposed to the water [22]. He has had success cleaning up certain water bodies by leaving these beds out at predetermined locations for months at a time and then cutting off any growth in the cattail plants afterward. We plan to expand on this idea by using beds of beneficial native Ohio wetland plants to clean water and making it into a connected network of solar powered, autonomous devices (similar in function to that of our current robotic device) that move to optimum positions in a water body based off of analysis done by data collected by our current water monitoring system.

## Acknowledgments

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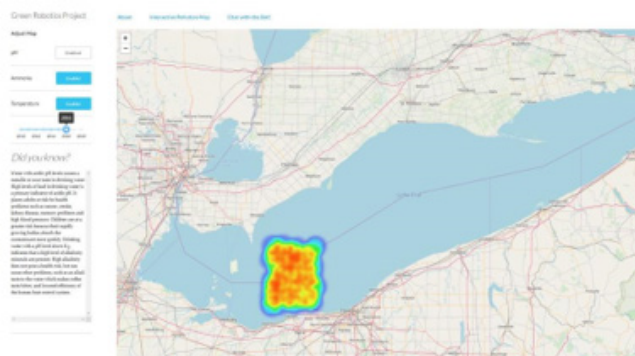Figure 1: Autonomous Robot in action in the lake



Figure 2: Visual Heat Map created by gathered data
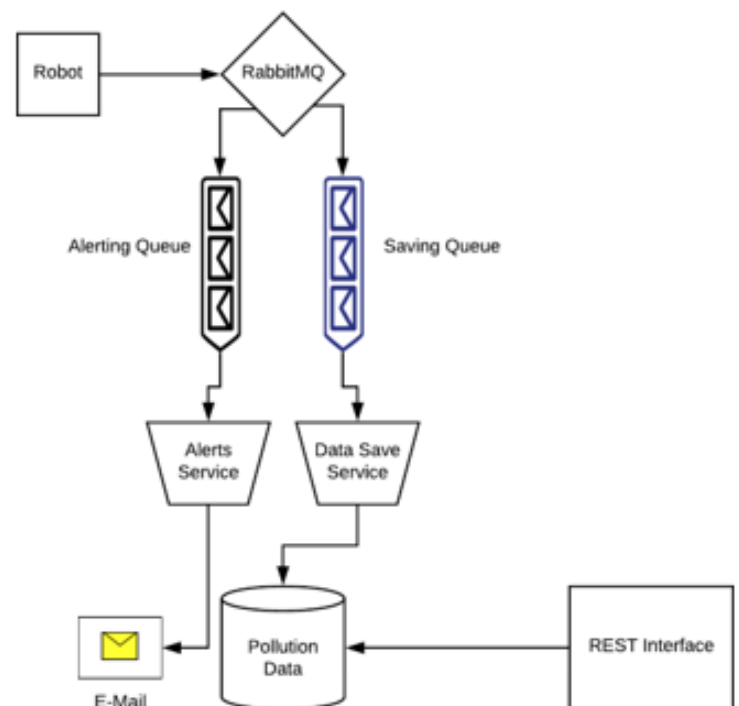


Figure 3: Data Management and Access System

Figure 4: Path traversal generated by Autonomous Algorithm



Figure 5: Natural Language Processing Interface
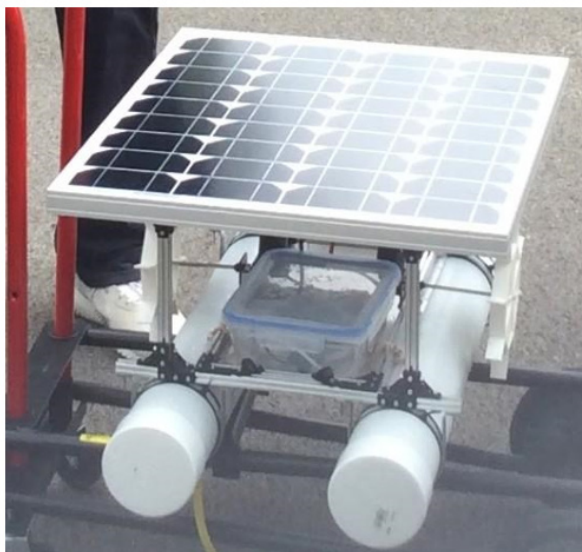
Figure 6: Prototype of the lake monitoring robot
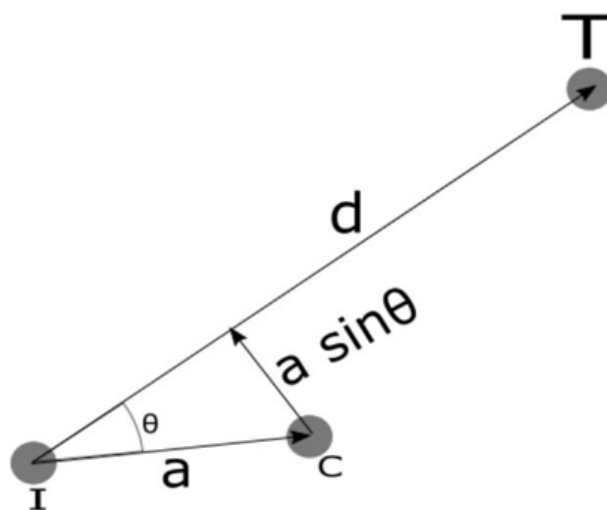


Figure 8: PD course correction:

(I – Initial Position, T – Target Position, C – Current Position)



Detected Colors:
Dark Blue
Gray
White
Dark Brown
Red
Black

Object
Height:
3.83 ft.

Vertical
Tolerance:
0.85 ft.

Horizontal
Tolerance:
0.87 ft.

Horizontal
Tolerance:
0.97 ft.

Pixelated Edge
Contour

Pixelated Edge
Contour ---------->

Object Length:
6.24 ft.
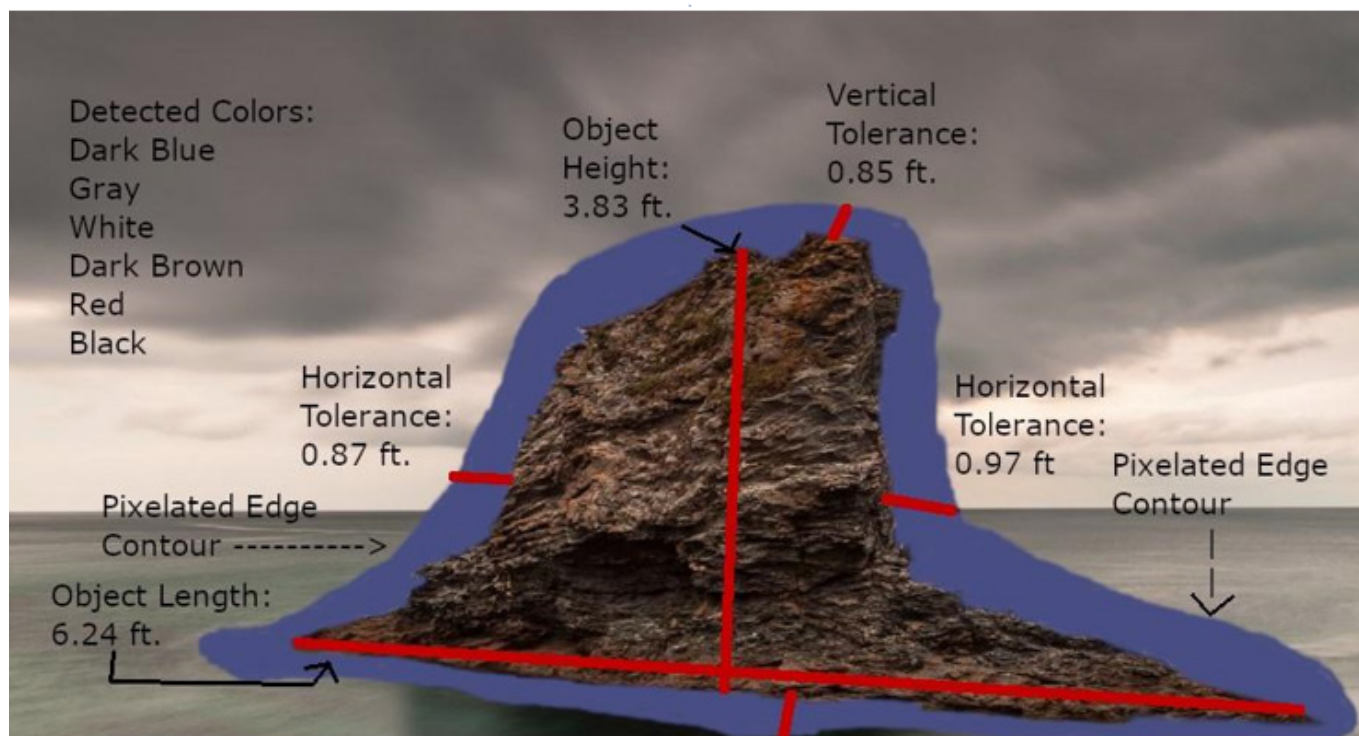
Figure 7: Detected Parameters in Computer Vision Software

Figure 10: CV Test: Small weeds/grass



Figure 9: CV Test: Rocks in a lake



Figure 11: CV Test: External Boat



Figure 12: CV Test: Lifeguard/External Building

Figure 13: CV Test: Harmful/Domestic Animals



Figure 16: CV Test: Swans/Birds



Figure 14: CV Test: Tree Branches



Figure 17: CV Test: Other Robots



Figure 15: CV Test: Lilypads



Figure 18: CV Test: Plastic/Excess Debris

Table 1: GPS Coordinates of each waypoint for our autonomous algorithm applied to Lake Erie

|      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Lat. | 41.7 | 42.0 | 41.4 | 42.1 | 41.6 | 42.1 | 42.6 | 42.2 | 42.0 | 42.5 | 42.2 | 42.8 | 42.4 |
| Lon. | -83.3 | -82.7 | -82.5 | -82.2 | -81.8 | -81.7 | -81.4 | -80.9 | -80.5 | -80.9 | -80.2 | -80.1 | -79.7 |

Table 2: Length of Path Traversed and Rotational Angle (From Vertical) for each Waypoint Pair Line Segments

|               | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Length (km.)  | 59.9 | 66.7 | 81.7 | 64.7 | 56.2 | 60.8 | 50.8 | 39.8 | 64.6 | 66.5 | 67.2 | 55.2 | 47.3 |
| Angle (Deg.)  | 26.6 | 18.3 | 23.2 | 38.7 | 11.3 | 31.0 | 51.3 | 63.4 | 38.7 | 66.8 | 9.46 | 45.0 | 26.6 |

Table 3: Experiment 1, Computer Vision: a) Accuracy of Detection

| Image | | Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 |
|-------|--|---------|---------|---------|---------|---------|
| Large mass of rocks | Detection Goal: Success | Success | Success | Success | Success | Success |
| | Size of Rectangle (pixels) | 199 x 154 | 171 x 153 | 320 x 214 | 217 x 145 | 193 x 154 |
| Small weeds/grass | Detection Goal: Failure | Failure | Success | Failure | Failure | Success |
| | Size of Rectangle (pixels) | N/A | 25 x 17 | N/A | N/A | 33 x 44 |
| External boat | Detection Goal: Success | Success | Success | Success | Success | Success |
| | Size of Rectangle (pixels) | 553 x 103 | 485 x 132 | 526 x 47 | 249 x 53 | 549 x 85 |
| Lifeguard/External building | Detection Goal: Success | Success | Success | Failure | Success | Success |
| | Size of Rectangle (pixels) | 394 x 203 | 320 x 334 | N/A | 432 x 220 | 460 x 189 |
| Harmful/Domestic animals | Detection Goal: Success | Success | Success | Success | Success | Failure |
| | Size of Rectangle (pixels) | 130 x 80 | 0 x 132 | 48 x 73 | 0 x 345 | N/A |
| Tree branches | Detection Goal: Failure | Failure | Failure | Success | Failure | Failure |
| | Size of Rectangle | N/A | N/A | 174 x 114 | N/A | N/A |
| Lily pads | Detection Goal: Failure | Failure | Failure | Failure | Success | Failure |
| | Size of Rectangle (pixels) | N/A | N/A | N/A | 352 x 201 | N/A |
| Swans/Birds | Detection Goal: Success | Success | Success | Success | Success | Success |
| | Size of Rectangle (pixels) | 247 x 120 | 134 x 143 | 35 x 125 | 37 x 116 | 139 x 105 |
| Other robots | Detection Goal: Success | Success | Success | Success | Success | Success |
| | Size of Rectangle | 336 x 81 | 306 x 83 | 331 x 108 | 327 x 49 | 319 x 139 |
| Plastic/Excess debris | Detection Goal: Success | Success | Failure | Success | Success | Success |
| | Size of Rectangle (pixels) | 562 x 276 | N/A | 536 x 258 | 611 x 391 | 430 x 321 |

Table 4: Experiment 1, Computer Vision: b) Robot motion based on vision

| Image | Time for Detection (s) | Robot Turns (Yes/No) | Decision Correct (Yes/No) |
|---|---|---|---|
| Large mass of rocks | 5 | Yes | Yes |
| Small weeds/grass | 10 | No | Yes |
| External boat | 3 | Yes | Yes |
| Lifeguard/External building | 4 | Yes | Yes |
| Harmful/Domestic animals | 9 | No | No |
| Tree branches | 8 | Yes | Yes |
| Lily pads | 12 | No | Yes |
| Swans/Birds | 7 | Yes | Yes |
| Other robots | 13 | Yes | Yes |
| Plastic/Excess debris | 7 | Yes | Yes |

Table 5: Experiment 2: PD Course Correction Control

| Trial | Initial | Latitude | Longitude | PD | Azimuth Change | $a \times d$ | $\cos \theta$ | Displacement | Updated Location |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Home | 40.1290474 | -83.1815978 | Yes | Initial: -1.8029 <br><br> Final: -0.3048 | -6.68E-03 | -0.887 <br> Desired: -0.9 | Latitude: 5.42E-05 <br><br> Longitude: 1.041e-4 | Latitude: 40.19010162 <br><br> Longitude: -83.8184939 |
| 2 | Patio | 40.1290558 | -83.1815246 | Yes | Initial: 1.0624 <br><br> Final: 0.4628 | -1.13E-02 | -0.1156 <br> Desired: -0.13 | Latitude: 9.1800e-5 <br><br> Longitude: 1.07E-05 | Latitude: 40.1291476 <br><br> Longitude: -83.181514 |
| 3 | Road | 40.1292388 | -83.1815075 | Yes | Initial: 1.0297 <br><br> Final: 1.0297 | -2.26E-02 | -0.0931 <br> Desired: 0 | Latitude: 1.83E-04 <br><br> Longitude: 1.71E-05 | Latitude: 40.1314006 <br><br> Longitude: -83.183521 |

# Mind the Gap: A critical analysis of school ethnography
## By Melissa Mahan

## Abstract

School ethnography is a relatively young form of scientific inquiry, originally designed to solve social problems in the late twentieth century. As such, there are a series of prevailing issues that plague its use. This analysis searches to pinpoint what these issues are, how they contribute to knowledge gaps in school ethnographies, and the problems of interpretation and application that can arise from them. This will happen through first an evaluation of past ethnographic work and existing critiques to identify the most glaring issues, and then an application of how said issues are relevant to more recent ethnographies. Finally, this paper will conclude with a series of potential solutions that would help to alleviate some of these gaps.

## Introduction

Education has always sought to prepare young people for life, but the goals it sets for what skills they will need varies across time and communities (Ogbu, 1981). Dr. Shirley Jackson, President of the Rensselaer Institute, identifies education as preparation for the economy (Jackson, 2007). This idea of education as a market tool is not unique; while Jackson was still in primary school, John Ogbu formulated the cultural-ecological theory, which assumed that formal schools are designed to provide skills for jobs (1981). This is owing to the fact that, while it is not a perfect measure, the amount of education a child will receive can generally predict their economic outcome (Ogbu, 1981). Owing to a desire to see more students receive education credentials and therefore improve their economic prospects, a panel of influential individuals in education met in 2007 to discuss how to better prepare students for jobs and life (Spellings, 2007. Some of the desired skills are learned through socialization rather than daily lessons, but are nonetheless important (Otto, 1985). Beyond textbooks and spelling tests, schools are the medium through which young children are trained in how to behave oneself in society (Spindler and Spindler, 1985). Jean Schensul firmly states that "education is communication," (Schensul, 1984).

Failure in a formal school setting can stem from a variety of factors, one of these being inadequate communication in the classroom (Maxwell, 1985). This is likely to occur when people of different communication styles have no translation matrix, such as when teachers and students from different cultures are put in the same classroom with no explanation about how their styles may differ (Ogbu, 1981). Because the training system for teachers centers the communication styles associated with white, middle-class Americans, minority students are often tasked with this hurdle (Ogbu, 1981). This is problematic for the school system as a whole because if school is the way in which citizens are prepared for the economy, a failure to prepare any number of students is detrimental to the economy (Jackson, 2007). Currently, there is a high level of demand for high-skill workers, but not a commensurate number of young people in vocational schools (Jackson, 2007; Krupnick, 2017). Practices that do not factor in a student's background are potentially responsible for the United States' struggle to compete in STEM fields, as more than half of the population are either women or people of color; this failure to engage and prepare such a large percentage of academic talent can only serve to harm American strength in

the global economy (Hockfield, 2007).

Attempts to correct the achievement gap—the notable difference between equally talented and intelligent students from different backgrounds—have frequently focused on understanding student placement and teacher capability through standardized testing, such as No Child Left Behind policies (Spellings, 2007). However, such benchmarks have often neglected to account for the needs of local economies and community-based markers of success (Maxwell, 1985). As a result, schools that reach for more funding must sometimes prove their success at the cost of accurately preparing students for a future in their local economy (Jackson, 2007). This is evident in high-skill industries, which often require training at a vocational school or the equivalent of an associate's degree; high schools that send students to four-year institutions receive a greater amount of funding, even if those students drop out within a semester or never utilize their degree (Department of Education, 2018; CTE Statistics, 2018). In comparison, a high school that sends students into the workforce with a certification from vocational or two-year institutions are perceived as "failing," even if the student finds immediate employment and is financially solvent (National Student Clearinghouse Research Center, 2018). Testing, although initially designed only to chart student growth, can also be detrimental to individual students because it cannot be done without an obvious judgment of student worth (Sexton, 2007). This can inhibit all children, but particularly those most susceptible to believing that their worth as a human being is correlated to success—or failure—in the classroom (Brown v. Board, 1954). Put succinctly in the Brown v. Board of Education (1954) case ruling, "A sense of inferiority affects the motivation of a child to learn."

Ethnographers seek to categorize what is taught and learned through any culture between people, as anthropologists are trained to see culture as a dialogue of people influencing each other rather than a strict lesson plan of unchanging requirements (Spindler and Spindler, 1985). Cultural transmission is not always formal; forms of humor, the tone of voice used to discuss a topic, and infractions for violating social norms are all indicators of underlying belief systems and are ways in which culture is perpetuated (Maxwell, 1985). When applied to the school system, this means that ethnographers must focus on the "hidden curriculum" of roles, expectations, and norms that children learn through socialization in

schooling (Otto, 1985).

When an ethnographer enters a classroom to begin a study, they bring with them an anthropological perspective; this training encourages the researcher to conduct a holistic study in order to discover the social environment and therefore explain possible reasons for school failure outside of raw intelligence (Schensul, 1984). With properly applied ethnography, educators will be able to approach solutions with a more complete understanding of their nuanced environment (Otto, 1985). In short, ethnography gives clarity to a complex process (Otto, 1985).

## Problems with School Ethnography

Because the study of schools is often a cross between emic and etic perspectives, school ethnography is a step apart from traditional ethnography; a holistic ethnography will examine more than a single element in any culture and draw connections between aspects of the culture, but this is not universal in school ethnographies (Ogbu, 1981). When an ethnographer fails to conduct a holistic study, it can skew the data and subsequently, interpretation of the results. However, it is not in an anthropologist's training to intentionally fail to be holistic; this failure is often the result of extraneous circumstances. School ethnography is riddled with problems, but these begin in the fact that school ethnography is still in developmental stages (Ogbu, 1981). The youth of the discipline has led to issues in the standard of reporting, failure to conduct research outside of direct application, and a methodology that does not account for macro-social factors. Because so much of the discipline is nonstandard, funding sources can be tricky to find and there are discrepancies about what the appropriate amount of time or depth of research is needed to be conducted (Schensul et al., 1985). All of these issues can contribute to knowledge gaps in a study, which will then garner skewed interpretations.

School ethnography, in terms of theory, peaked in the 1980s. Both prior and after, there is comparatively little addition to theory; while the entire discipline is roughly 40 years old, its start-and-stop nature means that it has not been growing for its entire lifespan. For comparison, anthropology as a whole has roots going back nearly 100 years. Due to the infancy of school ethnography, there exists no standard of rigor for

reporting; while a study may be conducted from either an emic or etic perspective, there is no universal anthropological definition for school terms that an ethnographer can use, yet also there is no descriptive standard for which terms are to be defined for the audience to ensure that all people can interpret the work in the same way regardless of how the study was conducted (Watson-Gegeo, 1988). Ogbu defines this as a conceptual issue: what constitutes "school" varies between cultures, and this can extend to subcultures of socioeconomic class or local communities. This flexibility of meaning can include any word in school vernacular; the culture of any given school will have its own set of connotations and slang, formed by its environment, population, and history (Watson-Gegeo, 1988). Even though the ethnographer might attempt to use culturally neutral terms in order to minimize this effect, language is inherently full of connotations; a failure to define key pieces of study can lead to a misinterpretation by the audience (Maxwell, 1985). This misinterpretation is doubly problematic because the audience frequently includes educators with limited or no ethnographic experience (Watson-Gegeo, 1988; Schensul, 1984).

Anthropology as a discipline varies in its goals: for some anthropologists, application is a natural and necessary end for investigation, while for others the knowledge gained is its own end. School ethnography as a subfield of anthropology, and perhaps ethnography in general, was not generated with this same flexibility: it was borne from a desire to mend social problems, and studies are thus almost exclusively done for applied anthropology (Ogbu, 1981). School administrators realized that until they knew the needs and desires of the student, they were forced to rely on their intuition (Maxwell, 1985). The direct result of this is that schools are not studied until there is a problem to be fixed; successful versions of the school can only be studied via nostalgia, as in Tim Hallett's 2010 ethnography of Costen Elementary School. Ethnographers struggle with this limited window of study particularly when they try to understand the history of school policies and administrators, as history can color the way new or refurbished ideas are received (Hallett, 2010). In some ways, this process of studying memory is inherent to ethnography as part of the soft sciences—cultures and subcultures are constantly changing, so studying the memories of a people will always yield different results from an ongoing observation. Understanding history as it happens is

most valuable, however, because even when an ethnographer can find knowledgeable, talkative informants, their study is limited to the informants' memories and prejudices and may not include information the researcher finds relevant.

School ethnography assumes that problems that occur in the school can be solved in the school (Ogbu, 1981). These studies are often conducted through "microethnography," in which the anthropologist will focus closely on a single perceived problem, usually with the intent of remedying the individual issue without making significant change to the established system (Ogbu, 1981). While this at first seems common sense, it ignores broader macro-social influences that impact actors within the school environment; a student who spends the entire night taking care of their baby sister because their parents must work through the night will be tired and inattentive no matter how engaging and well-planned the lesson (Ogbu, 1981). The limited scope of the study extends its shortfalls to the solutions proposed, and the result is that systemic changes are not even discussed (Ogbu, 1981). Microethnography can even be so limited as to ignore the culture of the school outside of a single classroom (Ogbu, 1981). Who a microethnographer speaks with can be problematic because they are likely to select the most relevant actors to the interaction they seek to explain, but this means that they have a strong chance of forgetting to include all of the "invisible" actors that influence the school setting; there are no principals, pastors, soccer coaches, or parents in the classroom on any given day, but each of these people are still able to have a direct effect on the lives of students and teachers (Ogbu, 1981). Researchers conducting microethnography attempt to gain a full understanding of a single aspect of the school, but this comes at the cost of understanding the school as a system with interconnected pieces.

There are further issues in the actual process of school ethnography. Data collection, like data reporting, is still a nonstandard process. Although they are not the same, qualitative and naturalistic studies are sometimes termed "ethnography" simply because they so frequently overlap (Watson-Gegeo, 1988). When interviewing informants, ethnographers have a tendency to ask only transactional questions without supporting structural ones; this leaves data regarding the structure of the school open to the researcher's assumptions

(Ogbu, 1981). Because informants are used to describe the makeup of the school as a whole, research that treats random sampling as a purer form of science has a stronger possibility of being skewed; rather, ethnographers must choose individuals who are representative of the group in order to gain the proper perspective (Otto, 1985). Continually leaving knowledge gaps in any realm is more problematic for some researchers than others, as Ogbu notes that some ethnographers are prone to becoming disillusioned with the educational system and their results show clear bias (Ogbu, 1981).

The decision to conduct a school ethnography does not always stem from pure curiosity. Research is expensive, and ethnographers who conduct a long-term study are likely to get their funding from the school; this can directly, and indirectly, affect the results of the ethnography (Ogbu, 1981). When research funding comes from the administration, school officials are able to exert pressure on the researcher to seek applied rather than basic ethnography, to investigate an area that the researcher believes to be irrelevant, or to provide solutions that are in line with existing values and practices rather than suggest any form of disruption (Ogbu, 1981). Further, limited funding can prompt ethnographers to engage in "blitzkrieg ethnography," in which the researcher enters the school for very limited amounts of time and quickly draws their conclusions (Rist, 1980). Blitzkrieg ethnography is similar to microethnography in that both rely on a limited scope of actual research, leaving many pieces open to the researcher's interpretation. Unstable funding         can lead to both of these practices, as some ethnographers find it tempting to begin drawing conclusions before the research period has completed (Ogbu, 1981).

The results and application of school ethnography can be both supported and limited by theoretical frameworks, which encourage ethnographers to focus most on specific situations (Watson-Gegeo, 1988). Researchers are often trained in similar fields, and these theoretical frameworks may be common to more than a few. Because researchers often share a theoretical background, they are likely to interpret results in a similar manner to one another without seeing how their own background sways them (Ogbu, 1981). When conducting an ethnography, researchers often shy away from checklists, meaning that each study is subject to the whims and biases of the individual ethnographer's training and attention span (Watson-Gegeo, 1988).

Using this approach—inherently nonstandard—does not push an ethnographer to be critical of their own methods or broaden their scope, which in turn has the potential to stagnate innovation about both design and application of school ethnography (Ogbu, 1981). This fault is evident in the idea of cultural mismatch, which supposes that minority students do poorly in school as a result of communication styles that differ between themselves and their teachers (Ogbu, 1981). The perceived appropriate solution would be to replace Anglo teachers with ethnically relevant teachers, but there is little evidence to show that this application has been successful (Ogbu, 1981). Despite the fact that this misapplication demonstrated how strict theoretical frameworks can be inhibitive, not all ethnographers believe in conducting an ethnography absent such well-worn paths (Erickson, 1984). Watson-Gegeo notes that one way to overcome this issue would be to chart the structure of the school and participant interactions on a more abstract scale when attempting to apply theories, as a greater degree of abstraction allows the researcher to think more broadly about the implications of their observations (Watson-Gegeo, 1988).

## Critical Proof

*Old Order Mennonite One-Room School: A Case Study (Dewalt and Troxell, 1989)*

While Old Order Mennonite communities exist within walking distance of secular American communities, the differences in values, beliefs, and education systems are striking. Notably, the integration of community within education is so intense that the two are, in some ways, inseparable (Dewalt and Troxell, 1989). This integration speaks to the problem of school ethnographies discerning between school and community cultures: in seeing a setup in which the two are very alike, it is easier to distinguish minute differences between the two ecosystems in more separated secular schools. Although the study was conducted in the late 1980s, the Old Order belief in tradition as a virtue gives ethnography about Old Order structures a long shelf life.

Dewalt and Troxell (1989) worked together to collect data for 6 months, ending in January 1988. Although the study itself was done for a short period of time, Dewalt and Troxell noted that they spoke with the teacher, several parents and students, and the local

bishop for interviews. Researchers even included some of the "invisible" actors, such as the superintendent of the local public (secular) schools and others who had contact but not intimate interaction with the Mennonite school (Dewalt and Troxell, 1989). The speed with which the study was conducted was in part possible because one of the researchers had been engaging with the Old Order community for over a decade (Dewalt and Troxell, 1989). The study's methodology was rigorous in that the researchers were able to frequently discuss their interpretations of informants' answers, which enabled Dewalt and Troxell to provide a reliable account of their data. Whether the data is accurate, however, is a separate question; the ethnographers do not doubt their results, despite the fact that in small, deeply integrated communities such as those of the Old Order Mennonites, distancing oneself from the community in any fashion could mean total upheaval of one's life (Dewalt and Troxell, 1989). If the teacher were to express a strong dislike of the prescribed teaching methods or curriculum, the community's preeminent emphasis on tradition could mean social sanctions (Dewalt and Troxell, 1989). Thus, while Dewalt and Troxell were able to confer with their informants on many occasions to discuss each person's answers, readers must note that the answers for some informants may have had social pressures attached.

The Old Order school takes pride in its ability to design its own curriculum according to the needs of the community (Dewalt and Troxell, 1989). Mennonites believe that a successful student is an obedient one, who learns by observation the norms of the classroom regarding instruction (Dewalt and Troxell, 1989). Further, a successful student would learn teamwork and bond with the community at large to develop a group identity rather than an individual one (Dewalt and Troxell, 1989). Because of this, students receive multiple recesses every day to play with one another (Dewalt and Troxell, 1989). Texts used in the curriculum are crafted specifically to indoctrinate pupils with community values such as hard work and religious faith, and students are graded on their ability to answer tests factually rather than provide analysis (Dewalt and Troxell, 1989). In contrast to standardized testing in the public school system, Mennonite schools consider the social development of young people to be more important than their academic development. This is important to note because Dewalt and Troxell's (1989) analysis of community values gives

rise to this conclusion, underscoring the need for an ethnographer to understand local values and belief systems when evaluating what education is meant to accomplish.

An examination of the curriculum and structure of Old Order Mennonite schools is useful to understand the integration of school and community and can serve as a contrast for secular schools. Mennonite schools prepare students for community life through strict social norms, and the curriculum demonstrates a commitment to maintaining community isolation by eschewing any mention of modern media or areligious scientific theories (Dewalt and Troxell, 1989). The set-up of the school is such that children learn how classes are conducted through observation of older students and by mirroring their actions. Repetition of classroom life is evident in that researchers estimate that less than 5% of class time was used for giving instructions, and only 35% of the entire day is used by the teacher for statements of any kind; in contrast to studies from secular schools two decades prior that claim nearly three fourths of class time is consumed with the teacher speaking.

Dewalt and Troxell's (1989) inclusion of the school curriculum and standards of success are valuable to the ethnography in that they serve to form a holistic picture of Mennonite school life. Because of the limited number of students, community members, and administration, as well as the strong emphasis Old Order Mennonites place on group conformity, the researchers were able to choose a representative sample of informants. The strong integration between Mennonite adult society and expectations of schoolchildren's learning enabled Dewalt and Troxell to demonstrate what a school with absolutely no cultural mismatch would look like. Finally, while the standards of what constitutes a "successful" academic career are different, the researchers were able to demonstrate the idea proposed by Jackson, that the point of education is to prepare students for the economy: Mennonite students are prepared for their own, insulated, economy (Dewalt and Troxell, 1989; Jackson, 2007).

Although the study had great strengths in describing the setting and local practices, descriptions of connotations were not always explicitly included. This is evident in that the researchers raise questions in their closing statements about the children's perception

of whether all instruction is to be regarded as education (including any given in religious services or at home) or if only that which occurs in the schoolhouse qualifies. Reading is described both as a task and as a form of entertainment and pleasure; Dewalt and Troxell mention that reading represents a rest from physical labor but do not discuss whether students include reading in the same category as social activities and physical play, or if it is more strongly associated with schoolwork and religious studies.

*Second Culture Acquisition: Ethnography in the Foreign Language Classroom (Robinson-Stuart and Nocon, 1996)*

One of the most enduring problems school ethnography appears to have is with the integration of macro-level culture and the classroom as a microcosm. Macro-level culture would be difficult to escape in a language class, as part of the curriculum entails studying the ways in which different cultures interact and how language frames those interactions. Additionally, teachers must be clear about the connotations of the terms they use, because cross-cultural translation can result in interesting word choices. Language classrooms are therefore a near-ideal candidate for analysis of the ways macro-culture and education processes are intertwined.

Interestingly, language and culture are not universally taught together; although language is dependent on the local dialect for daily use, the structure of a language can be taught in an academic setting that allows students to distance themselves from cultural actors who use and create language (Robinson-Stuart and Nocon, 1996).

To study acculturation in a foreign language classroom, Robinson-Stuart and Nocon (1996) conducted written ethnographic interviews in the fall of 1991 with approximately two dozen university students in a Spanish class. While this suited the researchers' timeline and goals of the study, it did not create a holistic picture of the foreign language classroom. The ethnographers were limited to what students chose to reveal about their experiences, rather than being able to watch minute but relevant interactions unfold in real time. Additionally, the limited time frame of the study—given that it was done only once (with one follow-up), rather than as a continuous longitudinal study—created further issues in the idea of holism, as any number of macro-cultural factors could color the experiences students had in a given year (Robinson-Stuart and Nocon, 1996). The researchers conducted a microethnography, as it is a

popular format (Robinson-Stuart and Nocon, 1996).

Like many school ethnographies, Robinson-Stuart and Nocon's (1996) investigation was done for application; that is to say, the researchers had a specific problem and evaluated whether their particular criteria could solve it. The study itself focused on the effectiveness of cultural training assignments, which included interviewing native Spanish speakers and learning about the native speaker's culture (Robinson-Stuart and Nocon, 1996). The goal of these assignments was to foster a greater sensitivity toward cultural differences and give the students an example of using Spanish in everyday life (Robinson-Stuart and Nocon, 1996). The theory behind the creation of this process of acculturation by interaction drew their inspiration from previous studies regarding language and cultural understanding—more specifically, the lack thereof (Robinson-Stuart and Nocon, 1996). While the researchers note the prior studies, they do not discuss the ways in which the cultures of those schools are similar or different from their chosen university (Robinson-Stuart and Nocon, 1996). Because the assignments had the intent of minimizing xenophobia and increasing students' desire to study Spanish as a cultural transmission agent, it would be highly relevant for the researchers to include a description of the local politics regarding linguistic imperialism and attitudes toward multiculturalism and diversity.

Unlike participant observation, the interview format described by the researchers subtly shapes how responders were meant to use terms, rather than allowing informants to describe their own definitions (Robinson-Stuart and Nocon, 1996). For example, one of the questions (and its corresponding sample response) uses the term "American culture" (Robinson-Stuart and Nocon, 1996). This is important to note, because the wording of the question implicitly directed students to think of culture as a broad, nationwide phenomenon, rather than a local, community-specific one. However, the application of this subtle instruction is not universal; another question that asks about "Spanish-speaking people" garners a result about "Mexicans," belying the student's associations (Robinson-Stuart and Nocon, 1996). The issue Robinson-Stuart and Nocon (1996) faced in both design and reporting stem from the common problem of school ethnographers failing to define their terms. It is easy to remember the importance of careful description when a word has no easy translation between languages, but much harder to be exacting

when both researcher and informant assume their interpretation of semantics is the correct one (Robinson-Stuart and Nocon, 1996).

*The Myth Incarnate: Recoupling Processes, Turmoil, and Inhabited Institutions in an Urban Elementary School (Hallett, 2010)*
Although the majority of educational institutions in the United States are not minority-based, such as ESL classes or Mennonite schoolhouses, there is a disproportionate number of publicly available ethnographies that center on "othered" institutions. Hallett's (2007) study of Costen Elementary School, however, is an example of what he describes as a standard, urban Midwestern school when national policy was on the cusp of No Child Left Behind (NCLB), the practices of which left profound and lasting impacts on American education. The Myth Incarnate is a paper based on Hallett's original 2007 ethnography, *The Leadership Struggle: The Case of Costen Elementary School.* The two are nearly identical, except that The Myth Incarnate includes more thoroughly developed ideas and *The Leadership Struggle* features more raw data. Because they were written regarding the same case study, both will be referenced in this analysis.

Costen Elementary School is a fictitious name for a real school in the Midwest, which Hallett (2007) studied for just under two years, ending in summer 2001. He began his fieldwork soon after a new principal, Mrs. Kox, was hired for the school; he was therefore present for significant administrative changes implemented with the same idea behind NCLB policies: accountability. Accountability, originally a business term, is the idea that educators must prove their merit by demonstrating student success, typically done through standardized testing. Accountability as a functional method relies on the assumption that the only significant difference between successful and unsuccessful teachers is personal talent or work ethic, and that any other factor (e.g. funding, support from the community, undiagnosed learning disabilities, dialect barriers) is irrelevant to performance. That Costen's school council held this assumption is evident, as Hallet notes that benchmarks for student success were not tailored to individual students or classes, but rather to the entire school district. Accountability policies caused a cultural shift among staff in Costen, during which teachers became less trusting of the administration (Hallett, 2007).

Because Hallett (2010) entered Costen after Kox had been principal for several months, he could only establish a basis of what the prior structure of the school looked like through interviews with teachers. Hallett's (2010) interviews included teachers, local school council members, and administrators employed by the school at that time. Hallett's study notably did not include interviews with students, past principals, or teachers. This is important because the only informants he had were directly impacted by—and therefore held clear convictions either for or against—the changing policies; there were no bystanders who could speak to the accuracy of the informants' memories or comment on potential biases.

The majority of Hallett's observations took place in either meetings or lunches. This method inadvertently lends itself to microethnography, as the majority of a teacher's day is not spent in the breakroom or meetings, and thus Hallett's observations of how teachers were impacted by policy changes is subject to each teacher's interpretation of how their day has changed. Because he speaks with 27 teachers, his results are likely accurate as the high number helps to account for teachers' differing priorities and memories. Hallett (2010) notes the limited nature with which he is able to observe the past: despite teachers' accounts of a perfect administration prior to Kox, Hallett learned that one former principal left the school for a job with a company she had hired to design Costen's curriculum and was therefore skating into potential ethics violations.

*The Myth Incarnate* describes the social effect of surveillance practices but speaks very minimally to how this social effect could carry into classroom activities and results, noting only that standardized test scores lowered slightly after accountability policies were implemented; ostensibly, this change was the result of teachers feeling stressed over Kox's administration (Hallett, 2010). Additionally, Hallett (2007) studies and reports on Costen in a way that minimizes the relevance of macro-cultural events in teachers' lives. Both of these are problems with holism, as they fail to integrate larger norms and events into minute systems. There is no evidence about what in the community was happening when the test scores dipped—whether there had been a traumatic event that impacted learning at a group level such as a citywide fire the previous year, or if life were continuing as normal for students; whether scores of teachers were dealing with their spouses losing jobs at a manufacturing plant, or if their stress could only stem from Kox's policies. The accountabil-

ity policies also did not account for personal struggles, despite the fact that Hallett (2010) notes that nearly half of the students in the school spoke limited English and more than three-fourths were in low-income households.

Hallett (2010) makes sure to define all terms related to his proposed theoretical framework and the official roles of teachers, administrators, and the local school council. Although he does not state specific measurements for student, teacher, or school success, he implies that the goal is to become competitive with a nearby school through standardized testing. These definitions are relevant in that subsequent school ethnographies are able to use Hallett's descriptions as a comparison for the way educator roles and curriculum targets shift over time.

In his conclusion, Hallett (2010) recommends that ethnography be used to ease transitions between accountability policies but does not provide any substantive ideas about how his own study could be used to aid schools with cultures similar to Costen in their adjustment to accountability and surveillance policies. In his ethnography of Costen, Hallett (2010) sought rather to understand the process of restructuring when such policies were introduced. The Myth Incarnate is a more thoroughly developed version of ideas Hallett first touched on during his initial ethnography, indicating that he did not draw his full conclusions until after he had completed his initial study. This is relevant in that school ethnography is frequently used only as applied anthropology, and a lack of understanding school processes as they apply to an individual institution can lead to a misapplication of the data; while there are problems in the reporting and format of Hallett's study, it overall is a step toward closing one knowledge gap.

*Twitter as a Learning Community in Higher Education (Ricoy and Feliz, 2016)*

Online education is no longer uncommon; indeed, it is sometimes the preferred method for students who have athletic, location, health, or career demands that would otherwise make education impossible. It is important to study online interactions because the setup of lessons and interaction could foster a culture distinct from traditional classrooms; education online may not have the same successes or failures as traditional formats.

Ricoy and Feliz (2016) sought to understand how an internet learning community demonstrates their engagement in a didactic process, using Twitter as their example. They chose to study a class from a distance learning institution, which ensured that students would not be engaging in their activities outside of Twitter. These activities consisted of discussions in which each member of the class was required to participate during the six-week course, which took place in June and July 2013 (Ricoy and Feliz, 2016). The institution, UNED, is in Spain; this presents a potential problem when applying theories of academic culture to American institutions, but this problem is mitigated by the fact that Twitter's platform remains the same across all cultures and etiquette would therefore be similar.

If school ethnography is still unstandardized due to its stall in developmental stages, internet education is even more so an infant. School ethnography is able to draw on practices in other disciplines for inspiration and guidance, but this is not so when discussing the use of social media in education (Ricoy and Feliz, 2016). The positive side to this lack of guidance is that researchers are careful to be absolutely clear in describing their methodology, which can help prevent the problem of misinterpretation by the audience due to a lack of definition. Ricoy and Feliz (2016) describe a multilevel approach to their study, using both qualitative and quantitative methods.

While the researchers make a clear attempt at being holistic, they fall victim to microethnography's tendency to evade macro-cultural integration. The ethnographers did not conduct a study on internet etiquette and slang across different social networking platforms, which could owe to the fact that not many exist. Digital ethnography is even younger than school ethnography, as computers and the internet were not readily accessible prior to recent decades.

Ricoy and Feliz (2016) were able to draw connections to patterned behavior, noting that students with low Twitter skills had a tendency to use "reply" rather than the assigned hashtags, similarly to how they had experienced email. Once students understood how to navigate the technicalities of the platform, researchers noted that they began to correct themselves and participate using the hashtags. The ethnographers note that a better understanding of the platform also correlated to a better classroom environment and rhetoric; applied to classrooms, this indicates that poorly defined social expectations in the classroom will have an immediate, negative effect on students (Ricoy and Feliz,

2016).

The researchers' choice to use Twitter was not fully explained but did have a helpful by-product; unlike digital ethnography that allows for people to edit their responses, tweets cannot be changed. Tweets can, however, be deleted; Ricoy and Feliz (2016) did not discuss whether their retrieval system, Hootsuite, retained deleted files.

*Twitter as a Learning Community* also notes that students did not frequently participate in class discussions late at night or over the weekends; although they were not physically in the classroom, regular work hours were still treated as the appropriate time to complete schoolwork (Ricoy and Feliz, 2016). Ricoy and Feliz (2016) note that throughout the course, the Twitter users demonstrated communication patterns that closely resemble those of students in traditional classrooms. However, the researchers neglect to comment on the influence of the students' educational and lifestyle backgrounds. This is important because the participants in the study were each seeking a master's degree, indicating that they were all born prior to 1991. Ricoy and Feliz (2016) further note that the participants were all new to Twitter and required sessions on how to use it rather than intuitively understanding the layout, indicating that their adolescence and earlier years of education were not marked by constant online socialization and classroom integration of online resources and platforms in the same way a child born in the age of iPhones might be. This investigation carries a clear bias toward the experience of millennial-aged people over that of older adults or younger teens and the results could not likely be applied equally to all age groups.

## Summary of Analysis

It is important for anthropologists to be aware of what pieces of information are missing from any study—to know what the gaps are. Without an understanding of what is wrong, it is impossible to work towards improvement of a study or the discipline as a whole.

The most glaring knowledge gap that continually appears in ethnographies is a failure of reporting. Without a full understanding of the assumptions made by the researcher and sociopolitical context of the school, it is impossible to truly know whether results can be trusted. It is entirely possible that each study evaluated in this

paper conducted a fully holistic study but did not report on everything because they felt that some aspects were not relevant or that the reader would make the same assumptions that the researcher had made.

Barring the idea that the details simply were not reported, the most extensive problem appears to be that the researcher did not completely investigate the context of the school, if at all. With the exception of the Mennonite school, which had been undergoing study for over a decade, none of the school ethnographies analyzed here were conducted over much more than a year (Dewalt and Troxell, 1984; Hallett, 2007; Ricoy and Feliz, 2016; Robinson-Stuart and Nocon, 1996). The result of not investigating the context is that the study cannot be integrated into macro-level culture and its generalizability is highly suspect; the ethnographic assignments in Robinson-Stuart and Nocon's (1996) study were deemed successful, but they did not account for how intense xenophobia was in the area or if there were strong feelings that English was linguistically superior. For example, if the area studied was generally accepting of native Spanish speakers, a more xenophobic area might rebel against being forced to interact in a different language.

As formal schooling continues to evolve, ethnographers will have to watch trends in distance education, specifically internet-based schools. The internet classroom, increasingly popular, is not an exact match for the interactions that can be observed in a traditional classroom and future ethnographers should work to establish how the two forms differ. There may be an enduring knowledge gap in distance education for some time, simply because there is not yet a fully developed theory of internet culture and therefore the context for internet-based schools will be muddled.

None of the studies evaluated in this paper noted the source of their funding, despite the fact that multiple past ethnographers have been clear about the pressure that a funding source can put on an ethnographer to interpret the data they collect (Schensul et al., 1985).

## Conclusion

Ethnographers who fail to report on all of their findings do not do so because they hope to mislead their audience or fellow scientists, but rather be-

cause they hope to be concise in a published work. With the dawn of the internet age, where access and storage of large amounts of material is cheaply—or even freely—available, this reduction should not be truly necessary. Rather than deleting bits of information deemed unimportant, anthropologists now have the option to publish an extended version of their work that includes field notes, a background on themselves to account for disciplined subjectivity, definitions thought to be "common sense" such as education or schooling, and more extensive description of the context of the school. In this way, readers can better understand whether a conclusion was drawn because all other options were ruled out, or if there is still room for spurious correlation.

Researchers should attempt to work towards a more comprehensive ethnographic method that could be applied to any school, so that the resultant theory of how the individual school—or schools in general—functions can be sounder. To be functional, this method would require a thorough investigation of demographics and school context, including a shared framework of how to approach different schools. Creating the framework would entail collaboration via definition; if an ethnographer reports on each of the details they investigated and how terms were defined across local cultures, other ethnographers have more data to work with as a comparison. This collaboration would also serve a second purpose: while school ethnographies have continued to exist, the most substantial theory-building took place prior to 1990, and if any discipline is to advance, it requires constant analysis and new ideas.

Unstable funding can lead to shortened studies and precludes truly holistic ethnographies; if possible, a government source should be established to provide for longitudinal, in-depth studies. While education is typically left to individual states, it is also a national interest; a national source may better serve the whole, as national benchmarks for success are often hotly contested.

Ethnography lends itself well to understanding the needs of a school, but even more so to understanding how a school fits into a larger sociopolitical and economic context. Past attempts at school reform have focused on keeping the United States a competitor in the global economy, but this has sometimes come at the cost of local economies being unable to sustain their workforce. Future ethnographies should investigate how to evaluate "success" as it means to the local economy, as well as to the national and global economies to better

prepare students for the whole market rather than all students competing in the same arena. Although new, school ethnography shows promise in terms of its development and future application..

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