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REYNOLDS COLLEGE OF ARTS AND
LETTERS

Chimera Toy

Elisa Peters

Abstract

“Chimera” is defined as an imaginary monster compounded of incongruous parts. In Greek mythology, it is a monster that has a lion’s head, a goat’s body, and a serpent’s tail. Further, an illusion or fabrication of the mind, something that exists only in the imagination and is not possible in reality. The chimera toy that I created includes a face resembling a dog, ears resembling something of an anteater, a turtleneck connecting to the body of a mushroom, and legs like Barbie or a marionette. In the face, initially drawn from resemblance of a personal childhood stuffed animal, its somber eyes reign true to the original inspiration. The ears were established to contrast what would have been a dog’s fluffy ears. I did not want to include the chimera toy with dog ears because it would create a full half-dog, so something had to unbalance the naturalistic features of a dog. I instead included ears that remind me of an anteater, or even the Tin Man from *The Wizard of Oz*. A human touch was needed in this chimera toy to match the humanistic eyes, and the turtle-neck-part-stem was the perfect choice, comedic at best. Lastly, the Barbie and/or marionette legs were created out of the need to balance out much of the heavier shapes that made up the bulk of the chimera toy’s body. I believe that since the legs are smaller and more irregular in shape and pattern compared to the rest of the body, this works well for the overall balance of the negative to positive space in the piece. Although not necessarily intended to have a greater meaning, I did go in with the intention of illustrating a certain emotion. I knew I didn’t want the toy particularly joyful, sad, or even creepy—exaggeration being a common factor in toys—so I opted for an expression of indifference, boredom, or even something that looks like desensitization. After creating this drawing, this piece allowed me to think about how people get caught up in their lives so fast—we find ourselves existing rather than living, trapped in the mundane while simultaneously managing the chaos that ultimately controls our life more than we realize, just like a marionette.



Just a Walk

Cassidy Farrar

Abstract

In the event of the pandemic that struck the globe, simple pleasures are all many had to fill their days. Baking, taking strolls, knitting, caring for plants, and more were and continue to be ways to distract some individuals from the monotonous life of online work and school while juggling the stress of remaining safe. But even these hobbies can feel soured when they begin to feel like a forced routine. Memories are sometimes a safe haven as well. Since the pandemic began, it was and continues to be a time when people cling to the ideas of what life used to feel like, and come to the realization that it may never feel like that again. In this autobiographical creative piece, I reflect on walking: a simple pastime of mine, which, prior to the pandemic, was a stable comfort. Since the world has come into a “new normal,” so too has this activity that once created so many formative memories. Nostalgia is one way to cope with collective and individual trauma, yet even coping mechanisms can feel useless in times of change, distress, and isolation. Through looking backward, I hope to reclaim what has felt tainted.

may, 2022–

Forward. It is the only way to go. I learn my new city by its streets. Red Lego-bricked neighborhoods bleed into cratered streets pulsing and humming with morning traffic. Birds and blurry talk morning radios are like a cup of black coffee on my walk to work. A mask clings loosely to my wrist. I buzz with hesitant, hopeful possibility. New stores to frequent, new cafes to house new stresses and relaxations, new memories to make. I hope. I am afraid to hope, after everything. Recent years were not what I expected, or what I thought I deserved. Graduation, the end of an era, lacked finality. I don't feel safe or comfortable in my hope, and I mourn the youth I lost. But after work, I can run over to the record store I haven't been to yet, just across the street. I should stop by the farmer's market tomorrow morning. These are the thoughts that weave between song lyrics as I learn. So I walk. I try to savor each step, one at a time.

january, 2021–april, 2022

Moving became a task. There must've been a dent in the right side of our secondhand mattress. I had two online lectures and four responses due, and stared blankly at the empty documents page where my essay should've been. There wasn't a path near my apartment I hadn't overstayed my welcome with. We were too familiar and the park was too crowded. I could feel the breath of unmasked strangers on my neck as I circled the allotted green space that was supposed to feel a little safer. Pointless trips to thrift stores were an unneeded risk. Inviting a friend required too much coordination and guilt. Some circles around the park with the friend I could trust, but it always felt forced. Exhausted. I didn't fit any of my stupid jeans any more. Imprints of the buttons pressed into my stomach. I felt huge and very, very small. I still do, sometimes. My partner sighed as the chill closed in. He had to walk tonight because he sat at work all day. I declined the invitation to join him.

"It's cold," I said.

I didn't walk much any more.

fall, 2018–march 14, 2020

Around and around. In the budding of my relationship, my partner made some small, seemingly meaningless comment about how much we walked. Hours of looped red brick paths and dodging late-night skateboarders or Nerf

gun fights. Eventually, we'd rest on a bench outside of the library or my dorm and chat between lengthy paragraphs of silence. We'd try to put off having to slink back into our cramped dorm rooms, because neither of us wanted to face small talk with our respective freshman year roommates. We fell in fast, clumsy love on those manicured sidewalks. He said it like it's a bad thing. We always *just* walked.

summer, 2018

Up and down the bleachers and circles around the rust track, a little bounce in every step. A lonely summer. A cigarette hung clumsy on my lips and the overwhelming scent of trying too hard soaked into my hair and clothes no matter how many times I showered. Waiting and waiting and waiting. Each step heavier with anticipation of no longer being held to the only place I knew. There are memories of football games and forming the friendships I held close to my chest screaming only the ghosts of chants now. But they were just that. I ended the evening at my second home. Bonfire and incense smoke finally beat out the tobacco in the lining of my jean jacket before I collapsed on my best friend Wade's mattress. It was always too cold down there. His house was just a short walk from mine. Attached at the hip, mattress on the floor, eyes on the ceiling. The memories of that house seeped into everything I knew about myself. But he wasn't coming with me because no one was, really and wasn't that the point? I was driving away. A stomach-twisting excitement of what the next four years would bring.

2017–2018

“Onward and upward!”

I tasted the night as I yelled into the thick, humid air. Armed with a Polar Pop in hand and the corpse of a chip bag giving its crumbs to my pocket, I thought I could conquer it. My world was the sidewalks and tentacles of cracked pavement off Main Street. Our rotating cast collected through the years of awkward growth gave rambling monologues with loud sessions of interruptions: budding relationships, sex, stress about learning lines, and irritation with our parents. World-shattering problems. Life packed into an activity we could afford. We'd climb on the old cemetery building or creep down the crumbling cement stairs onto the playground at night to smoke. Quiet and loud. Too much silence highlighted the terrifying night noises from behind the chain link fences. We'd walk to Sonic with our heads cloudy to meet others and share a large order of yellow, wax-covered tater tots. A diamond pattern

pressed into my thighs. I walked back at unsafe hours and told my parents in the morning I'd been at my friend Emilie's the whole night.

“We *just* watched movies.”

2014–2017

Back and forth. Steve's mouth pulled back into a grin and he paced the hardwood. I twirled his knotted leash and whispered the sacred word.

“You wanna go for a *walk*?”

He did. He twirled in circles, letting out excited yips, and pranced toward our glass door. It was the time of day I got to breathe air fresher than what felt so suffocated by my parents' minimum wage jobs.

One step onto the porch before calls of concern floated from the kitchen:

“You're going now? After dinner? It's going to get dark soon.”

“It's summer. It's only 6:30. I will leave one headphone out. I have my phone on me. I'll be fine,” says my teen angst.

The usual replies:

“Can one of us go with you?”

“It's just not safe being a girl alone walking.”

“Why don't you just call up Wade and see if he'll walk with you?”

“—and do you really need to be dressed like that? It might get unwanted attention and we just want you to be safe. At least remember to take Steve with you.”

Just around the neighborhood. I'd be back before sunset.

2010–2014

Side to side. Winding through rows and rows and rows of identical brick houses on identical streets. I always wanted to live in a neighborhood with other kids my age. I could ride bikes around and not fear plummeting down my hill at a million miles an hour into a deer or oncoming car. I used my friends' neat brick plots to live my dream: trick-or-treating where I didn't have to trudge in the cold to the rich neighborhood to get the me-sized candy bars. Neighborhood block parties. Walking over to Blake's house and then Kaylon's and then Evan's and then Hayley's. People I would come to know only through sporadic social media posts as we grew. I tagged along through their routes. We collected people from school as we walked, the group growing and shrinking, snacks at a few different stale, carpeted rooms or oily garage floors before someone had to leave for soccer practice. As the sun dropped lazily below the perfectly peaked rows of rooftops, I grabbed a ride home back to my winding, lonely streets. A warm and satisfied kind of tired.

2005–2010

Downward. Green and quiet, I stumbled through vines and poison ivy down the biggest hill probably in existence. It strayed to the left so I held on to trees and let them catch my downward momentum for the shortcut. Ferns grabbed at my ankles and willed me to fall. The creek that probably trickled with sewage waste water was outlined by mysterious crawdad caves puckering up from the mud. Thick and ancient roots stretched across to form a waterfall of steady droplets. There was an open area with the stumps I always planned to use for a bonfire someday but never got around to. Here is where I found my "dragon egg" that I kept in the sunroom. Dad was nice for not throwing the spongy marriage of moss and mud out, even when it started to stink. Behind the creek, I found hidden treasure in morels and turtles I named for the afternoon. Play-pretend characters still live here. They lurk behind the fallen logs and fade a little more every day. There was magic in isolation, then. Maybe there can be again. I don't remember the last time I walked down there.

It's overgrown now.

Effective Pedagogy About Racism in Literature

Isabella Eslick

Abstract

The purpose of “Effective Pedagogy About Racism in Literature” is to discuss strategies English Language Arts (ELA) teachers can use when teaching literature in which racism appears. This is a topic that is often lacking in the training of teachers. The piece examines the ELA classroom’s natural aptitude for incorporating race discussions into lessons. I also note the importance of teaching students about racism, especially as someone who experiences White privilege. The piece further explores how racism appears in literature, especially those which do not directly discuss racism. Through personal testimony of other English educators and my own notion of examples of racism in literature, I conclude that two strategies for teaching about racism I can use in my future classroom are creating a safe space for my students and comparing racist ideologies.

Modern educators have a multitude of responsibilities upon their shoulders. The first job of a teacher is obviously to educate students on certain subject matter and in my case, English Language Arts. The second, more daunting job of a teacher is to prepare students for the world beyond academia and, specifically, how to think critically about that world. This involves teaching students about the entirety of the world, including the things that people are often uncomfortable discussing. One such topic is racism. As a White woman, I may seem like an odd person to willingly start conversations about race. However, it is the privileged group's duty to use their status to fight injustice. Schools must teach students about racism, especially when it is in the texts we read. According to the National Council for Teachers of English, I should be "actively discussing racism and bias," to be an anti-racist educator ("Being an Anti-Racist Educator" 00:00:39-00:00:45). This causes an issue to arise, however. How can I effectively teach students about racism when I have never directly experienced it? In my classroom, creating a safe space for comfortable discussion and comparing past and present conceptions of race are two effective strategies I can use to educate students on racism.

There has been a recent national debate about whether schools should even teach students about racism. In Missouri alone, legislation was proposed in 2021 that "would ban... lessons that identify 'people, entities, or institutions as inherently, immutably, or systemically sexist, racist, biased, privileged, or oppressed'" (Bernhard). It is staggering that this bill was proposed in the first place since it ignores a fact about American society. Leaders in diversity education cite the root of this issue as people not wanting to admit that systemic racism is still rampant because "it runs counter to a narrative...of progress" that the country has tried so hard to push (Bernhard). The common mentality in America is that it is the most powerful country in the world. A country cannot be powerful if its citizens do not believe it to be, so those in charge convince them that all issues have been solved. Many Americans believe that we have moved beyond our past evils when this is not the case. It is imperative, however, that teachers educate students about racism due to the scope of what it influences.

Many educators are on board with this notion. The Rockwood School District in St. Louis County, for instance, set an example in 2021 as one of the largest public school districts in Missouri for creating a more diversity-inclusive curriculum. Administrators, teachers, and the school board were met with literal death threats from parents in the district, causing the superintendent and the director of education equity and diversity to resign. In the face of criticism, the district remained firm in its decision. Providing anti-racist education is "beneficial for students whose worldviews have been shaped by

racist discourse” as well as students who are “victims of racism” because it helps the development of social and emotional skills that the toll of racism impacts (Heaton 85). Since teaching anti-racism in the classroom can enhance overall student learning, school officials must back up the educators doing the teaching, just as the school board is doing in Rockwood. Administrators set the guidelines for teachers and prepare some of their resources. Hand in hand, school officials and educators must create an anti-racist curriculum that can be “taught sensitively due to its challenging nature” as well as “taught effectively due to the fact racism is real” and affects the lives of both students and teachers (Heaton 89). The question the recognition of these two stipulations brings up is how best to do it. As the culture surrounding discussions about racism continues to evolve, so does the study of how to teach it.

One of the major areas of study for anti-racist education is its natural ability to be incorporated into English classrooms. While some lessons are cut-and-dry, many of the topics taught by English teachers leave room for subjectivity and discussion of meaning. Even though English itself is a core subject in school, it can encompass nearly any subject imaginable. Dr. Allan Luke, a renowned literacy education theorist, describes English education as an excellent environment for “political interventions” and “struggles over the formation of ideologies and beliefs, identities and capital.” In other words, English teachers have the perfect natural opportunities to start meaningful discussions about politically charged topics, especially racism. Having students read literature that examines or contains examples of America’s historical and contemporary relationship to race encourages them to think about what it means to be “ethical and literate citizens” (Thomas 154). Literature that explicitly contains themes centered around racism is good for broader learning about the ideology. It gives a definitive basis for what racism looks like, who it affects, and how it affects them. This is an important beginning for anti-racist education.

English teachers should also be cognizant of the not as clear-cut racism that exists in other literature. This literature includes texts that do not contain themes about racism but still show racial bias; active discussions about this bias should then be started. Doing so allows students to critically think about the clearest depiction of race issues in America. This is especially helpful when we cannot choose what texts we teach; we can, however, choose how to teach those texts. Many of the novels English teachers are expected to create lessons over are publicly beloved, so some educators are wary of rocking the boat with them. We must help students challenge what they read, though, “if we want students to meaningfully understand the world around them” (Macaluso 286), and subsequently thrive in it. Differing ideas about how to best address racism in literature are circulating, but language arts being a major tool for anti-racist

education is readily agreed upon.

The initial strategy that English teachers must use for open discussions about race is ensuring their classroom is a safe space for students. In educational terms, a classroom is a safe space when the teacher and students have collaborated to create an environment where everyone feels comfortable sharing their full thoughts. Students should be shown that their ideas are appreciated, and teachers should be respected in return. As teachers, we must actively foster a safe space and aid students in doing the same. Matthew R. Kay, a leader in bringing anti-racist education into schools, describes the process of building a safe space for conversation as a relationship where the teacher acts as an example and implicitly encourages their students to follow suit. In this idea, the teacher models patient listening, active listening, and policing their own voice during class discussions and expects students to quickly catch on (Kay 32). The more we as teachers can show that what our students say is important, the more our students will think the same about their peers, not just us. If there is a disconnect of trust between the students and teacher or amidst the students, class conversations will not be successful for any topic but especially a controversial one like racism. Kay labels these difficult topics as “house talk” because they often do not leave a student’s home or friend group (33). The only way “house talk” is even remotely possible in the classroom is if the teacher-student relationships have already been established.

Discussion must also be engaging for students. For meaningful discussions, Kay suggests prioritizing what the students care about over content (34). There are many ways our lessons can be made relevant to our students; this skill is one of the main tactics taught in teacher education. Students will learn what they want to, so the least I can do is encourage them to learn at all. Literary and cultural theorist Carolyn Betensky concurs about prioritization when it comes to race discussions saying, “I am happy to leave them with an imperfect grasp of those texts and contexts if it means they are thinking more deeply about analogous formations in the present and their relation to them” (741). In this sense, the secondary job of teachers is more important than the first. Preparing students for the real world begins when students are ready to allow themselves to be open. That only happens when teachers actively work to make our classrooms safe spaces.

Conversations about racism are impossible if teachers do not allow the unease that consequently follows. When we find race discussions unwelcome “because of our own discomfort” then we should not call ourselves effective teachers (Betensky 743). Ignoring racism in the literature we teach perpetuates the perception that racism is not important if it is not violently happening in real-time. It sends the message to White students that they do not have to pay

attention to racism unless they are specifically asked to; the message received by students of color is that we do not genuinely care about them enough to call out someone's wrongs. Especially as White teachers, embracing the discomfort is crucial when teaching lessons about racism. Dr. Ebony Elizabeth Thomas, who specializes in the intersection of race and literature, studied what makes race conversations productive and found that planning for unease surrounding the topic is key. A White female teacher's lesson about the "n-word" successfully engaged students because it was "premeditated and strategic" while still being "exploratory" (Thomas 168). The teacher was able to lead her students in a meaningful discussion about racism due to her anticipation that the students would question the use of the "n-word" in the text they were reading. Teachers also cannot let the fear of offending students consume them; as long as there is an expectation that reparations will come swiftly after the mistake, students will not think differently of their authority figure. Unless teachers willingly invite uncomfortable discussion into our classrooms, no progress can be made for the benefit of students.

The best way to help our students critically engage with racism in texts is by teaching them about the differing interpretations of racism. These interpretations are often categorized into "old racism" and "new racism," but both have always been comparatively present. "Old racism" refers to the idea that behavior is only racist if it is "overt" and "intentional"; this notion "sets up a single story about what racism is and looks like" – that racism is violently discriminatory (Macaluso 283). The ideas of "old racism" are challenged by those of "new racism." This opposite way of thinking views racism as "a hidden system of power and domination," or, the systemic racial issues and microaggressions that lead to violent discrimination (Macaluso 283). Both ideas have to be considered in regards to addressing racism in literature since both are still very real truths about the history of race issues, they just were not named until modernity. While we should provide historical context for the popular ways of thinking about race when introducing texts to our students, we must not use this context as a crutch that causes us to disregard the racism in the literature (Betensky 733-734). Modern conceptions of racism should still be applied to past racist acts; if we do not, we once again bolster the belief that we have somehow moved past racism.

Critical theorist Dr. Michael Macaluso applied this technique to his teaching of *To Kill a Mockingbird*, as this novel has historically been thought of as breaking down racial barriers. From the perspective of 'old racism,' Atticus is the "anti-racist savior who defends Tom Robinson in court" (Macaluso 280). Atticus acknowledges that the violent mob and the ultimate lynching of Tom are wrong. However, 'new racism' paints Atticus as the major racist figure in the

novel because he never condemns racist ideology and even sometimes excuses it as bouts of indiscretion. Comparing “old” and “new” racism to other texts that feature the ‘White savior’ trope, such as *Dangerous Minds* which features a White woman beginning work at a predominantly Black school, or *The Help* that chooses a White woman authoring a book about Black maids as its protagonists instead of the maids, yields comparable results as *To Kill a Mockingbird*. Shining modern perspectives of race on literature, especially older literature, reveals how varied racism can appear in society outside of fiction.

Teaching novels that do not explicitly discuss racist ideology but still contain examples of racism, as much of Victorian literature does, can use the technique of comparing ideas about racism as well. The “casual racism,” as Betensky puts it, that exists in many British Victorian novels appears in the quick, hardly noticeable racist phrases that are sprinkled throughout the text (724). This casual racism is apparent in the allusions to ugliness (“as harsh as her features”) awarded to the woman of color in chapter 19 of *Jane Eyre* (though the woman is actually Mr. Rochester in disguise). *The Picture of Dorian Gray* also contains casual racism in the description of the “hideous” and “greasy” Jewish theater manager that depravedly keeps Sybil as his star actress. This racism has no bearing on the plot of these two novels; the stories would still be the same if the racist remarks were removed. It is because these remarks are not “centrally important that [makes them] important”; “casual” by no means implies less” or less important racism (Betensky 725). The pertinence of the racist quips is revealed by applying the concepts of “old” and “new” racism. Using “old racism,” neither of these novels would be deemed racist; there is no imminent danger for the characters being described. However, the racist commentary of the two characters illustrates the existence of systemic racism and the abundance of microaggressions in the historical context of the novels, similar to what people of color experience every day today.

British and American society historically and continuously thrive off of racism; these systems inform the worlds in which novels are written. The “point of becoming aware of the banality of incidental racism,” or casual racism, is not to insist that all older authors were racist; it is to “gain familiarity with the blithe ease with which it operates” in the literature to better understand the extent it appears in the real world (Betensky 728). Even if literature is not inherently racist, it still helps write the script for the racism we should expect to see. Macaluso advocates when reading any text as a class, examine “who has power and why” then discuss how the story would change if the power were given to someone else (284). This tactic not only initiates meaningful conversations about racism; it prepares students to talk about any injustice in the world.

Though teaching about racism is not a simple duty, it is imperative that it

be done to make students aware of issues within their world. As a future English teacher, I have an advantage because conversation starters are practically built into the literature we are expected to teach. As a White woman, I have to ensure that my anti-racist lessons are effective, or else I become part of the problem. Studying racism in Victorian literature has helped me find the best approaches to lead race discussions in my future classroom. My classroom will welcome diversity in thought, and we will not pigeonhole racism into one specific thing. The worst we can do as teachers is ignore the racism in our curriculum; the best we can do is educate our students to be cognizant of it.

WORKS CITED

- “Being an Anti-Racist Educator is a Verb.” *YouTube*, uploaded by National Council of Teachers of English, 23 Sept. 2019, www.youtube.com/watch?v=P9DCGbNnONY.
- Bernhard, Blythe. “Rockwood Teachers Call for Protection from Harassment Over Diversity Curriculum.” *St. Louis Post-Dispatch*, 5 May 2021, www.stltoday.com/news/local/education/rockwood-teachers-call-for-protection-from-harassment-over-diversity-curriculum/article_919a8228-3696-5714-aa27-0f1813e0e150.html.
- Betensky, Carolyn. “Casual Racism in Victorian Literature.” *Victorian Literature and Culture*, vol. 47, no. 4, 2019, pp. 723–751. <https://doi.org/10.1017/S1060150319000202>.
- Heaton, Adam. “I No Longer Feel Comfortable Teaching Here: The Need for Schools to Support Educators Teaching Against Racism.” *International Journal of Education Humanities and Social Science*, vol. 2, no. 3, 2019, pp. 85-90, ijehss.com/uploads2019/EHS_2_35.pdf.
- Kay, Matthew R. “Demystifying the “Safe Space”: How to Lead Meaningful Race Conversations in the Classroom.” *American Educator*, Fall 2019, pp. 31-34, www.aft.org/ae/fall2019/kay.
- Macaluso, Michael. “Teaching *To Kill a Mockingbird Today*: Coming to Terms With Race, Racism, and America’s Novel.” *Journal of Adolescent & Adult Literacy*, vol. 61, no. 3, 2017, pp. 279–287. *JSTOR*, www.jstor.org/stable/26631122.
- Thomas, Ebony E. ““We Always Talk About Race”: Navigating Race Talk Dilemmas in the Teaching of Literature.” *Research in the Teaching of English*, vol. 50, no. 2, Nov. 2015, pp. 154-175. *JSTOR*, <https://www.jstor.org/stable/24890031>.

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Racial/Ethnic Identity, Impostor Feelings, and Self-Esteem of Students of Color: A Literature Review and Future Directions

Kayla Curry

Abstract

An abundance of research has linked impostor phenomenon (IP) with low self-esteem, poor mental health, and poor academic performance. This review of the literature reveals vulnerable populations including women and certain racial/ethnic groups and also identifies gaps in the current research. There is a relationship between racial/ethnic identity, gender, and experiences of impostorism and low self-esteem, but inconsistencies amongst the extant research suggest a need for an intersectional approach that further explores the precise mechanisms in which racial/ethnic identity and gender interact with impostor feelings and self-esteem. This review also examines other factors that may contribute to low self-esteem and feelings of impostorism such as first-generation status and the quality and quantity of social support networks and use the findings to develop suggestions for reducing IP and low self-esteem in college students of color. Implications for student mental health and academic achievement are also discussed.

INTRODUCTION

It seems to be human nature to compare ourselves with those around us—to our peers, our co-workers, to the images we see in the media. Our self-image is often molded by societal standards and these standards can influence our self-esteem (Rumbaut, 1994). When our self-image does not line up with these standards, the result is low self-esteem which is also continuously linked to poor mental health outcomes and the impostor phenomenon (Cokley et al., 2017; McGregor, Gee, & Posey, 2008; Peteet, Brown, Lige, & Lanaway, 2015). Impostor phenomenon is the feeling of being an intellectual or professional fraud, that one's achievements can be attributed to external factors such as luck rather than individual skill or intelligence (Clance & Imes, 1978). Impostor feelings plague certain populations more than others. Existing studies have shown that women (Clance & Imes, 1978; Cokley et al., 2015; McGregor, Gee, & Posey, 2008; September et al., 2001), first-generation (Peteet, Montgomery, & Weekes, 2015; Canning et al., 2020), and students of color (Bernard, Hoggard, & Neblett, 2018; Cokley et al., 2013; Craddock et al., 2011; Lin, 2008; Peteet, Montgomery, & Weekes, 2015) experience impostor feelings at higher rates than their male, white, continuing generation counterparts.

Studies suggest the poor mental health outcomes associated with low self-esteem and impostorism are also correlated with academic and professional achievement and retention (Bennett & Okinaka, 1990; Jaret & Reitzes, 2009; Majer, 2009). These outcomes can also be exacerbated for minoritized students living in predominantly white communities where higher rates of social dissonance, alienation, discrimination, microaggressions, and other forms of bias exist. Though much is known regarding the interrelationships between self-esteem, impostor feelings, and race/ethnicity, there are some gaps in the literature. This review sheds light on what is known from the existing literature, and also details important future directions that can help increase our understanding.

LITERATURE REVIEW

Self-Esteem As A Multidimensional Construct

Social scientists conceptualized and operationalized self-esteem in a number of ways over the years. This disagreement about what exactly self-esteem measures, and how to measure it, leads to inconsistent findings. One of the prevailing operationalizations of self-esteem is the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Rosenberg (1965) defines self-esteem as one's overall sense

of worth as an individual and the scale measures this using two dimensions: self-liking and self-competence. Phinney (1989) distinguishes self-esteem from racial identity through his conceptualization of a multidimensional model of race/ethnicity. Racial identity is concerned with to what extent one feels they belong to their racial/ethnic group as well as how they believe other groups may perceive their group. While Rosenberg made the important distinction of self-esteem as an outcome of social forces and examined it as it relates to social positions such as racial or ethnic categories and institutional structures such as schools or family, there is one important limitation of the Rosenberg (1965) measure.

Namely, Rosenberg's widely used scale does not adequately address the importance of assessing racial identity as separate from self-esteem. Phinney's (1989) model measures various dimensions of racial/ethnic identity. Commitment and attachment is the extent of an individual's sense of belonging to his or her group. Exploration is engaging in activities that increase knowledge and experiences of one's ethnicity. Achieved ethnic identity is having a clear sense of group membership and what one's ethnicity means to the individual. Failure to make this distinction between self-esteem and racial identity falsely presents measures of racial self-esteem as measures of self-worth (Rosenberg, 1965; Crocker & Major, 1989). Due to inconsistent or simply falsely determined findings, the scientific study of the relationship between racial identity and self-esteem as separate phenomena should be explored further.

Racial/Ethnic Identity and Self-Esteem Across Groups

Other researchers studying the relationship between self-esteem and race echoed this need for a sharp distinction. Crocker and Major (1989) carefully defined global self-esteem as feelings of personal self-worth, and racial or collective self-esteem as evaluations of the worthiness or value of the social groups to which one belongs (such as racial or ethnic groups). A person may have low collective self-esteem and high global self-esteem simultaneously. Theories of social identity and self-esteem suggest various social psychological mechanisms underlying the formation of ethnic images. For example, youths see and compare themselves in relation to those around them based on their social similarity or dissimilarity with the reference groups that most directly affect their experiences. These reference groups are often identified by youth via visible markers such as race, ethnicity, or gender (Rumbaut, 1994). Rumbaut found that ethnic self-awareness depends on the degree of dissonance or consonance of the social contexts which are basic to identity formation. When in a consonant context, ethnicity is not salient for youths, but salience of ethnicity is heightened in dissonant environments where there are clear ethnic group boundaries.

This dissonance is exacerbated when accompanied by disparagement and discrimination which may be found in predominantly white institutions (Harper & Hurtado, 2007; Hussain & Jones, 2021; Kotori & Malaney, 2003).

Based on his review of the literature, Rumbaut (1994) suggests that self-esteem should be lower in social contexts where the level of social dissimilarity is higher. However, other researchers observed that African Americans do not report lower self-esteem than their white peers (Porter & Washington, 1979; Rosenberg, 1979). Rowley (1998) expanded on this research which suggests other variables may have an insulating effect on self-esteem for African Americans. The study found that African Americans tend to make their social comparisons with other African Americans rather than with broader society which may in part be due to racial segregation in America. Rowley (1998) suggests other insulating variables could include a phenomenon called locus of control in which African Americans blame systems of discrimination and oppression for shortcomings instead of self-blame, whereas Asian Americans tend to have lower self-esteem. This may be because as the “model minority,” who are more or less socioeconomically equal to whites, they are unable to use locus of control as a protective factor against low self-esteem.

Other studies found a different result. In their literature review, Porter and Washington (1993) found that high personal self-esteem is related to good group image among Hispanic and Asian subgroups. They also suggest this could be explained by the “model minority” thesis, a variant of the social mobility paradigm which suggests ethnic groups with values that stress hard work and achievement will be successful economically and thus manifest a high personal self-esteem. Because most of the foundational literature focuses on Black populations, exploring the relationship between self-esteem and other races and ethnicities is important to understanding differences across groups.

Impostor Phenomenon as a Predictor of Self-Esteem and Psychological Well-Being

Over the years, research on self-esteem expanded to include other mediating phenomena related to it. Clance and Imes (1978) identified a phenomenon that affects women especially. It is termed the impostor phenomenon. Impostor phenomenon is the feeling of being an intellectual or professional fraud, that one’s achievements can be attributed to external factors such as luck rather than individual skill or intelligence. Research shows a relationship between self-esteem, impostor phenomenon, and psychological well-being, but the precise mechanisms of this relationship have been underexplored (Cokley et al., 2013; Peteet, Brown, Lige, & Lanaway, 2015; Peteet, Montgomery, & Weekes, 2015; Lige, Peteet, & Brown, 2017).

Extensive research on gender differences in experiences of the impostor phenomenon confirms that women experience higher rates of impostor feelings (Clance & Imes, 1978; Cokley et al., 2015; McGregor, Gee, & Posey, 2008; September et al., 2001). Cokley et al. (2015) studied gender differences in relation to IP and found gender stigma consciousness was a positive predictor of IP for women and men, but was stronger for women. Women who were more conscious of stereotypes associated with their gender were more likely to be concerned that others are using negative gender stereotypes to judge their intellectual competence. The study confirmed that while men also experience impostor feelings, there is a significant relationship between IP and GPA among women but not men. Women high in IP are likely to work harder and be more engaged in school, which leads to behavioral outcomes such as having higher grades. This finding is even more interesting given that there is not a significant correlation between IP and GPA. Yet, in the presence of other variables (e.g., academic self-concept), the path became statistically significant. For men, the link between IP and GPA is only indirect and is mediated by academic self-concept. Men with lower IP had higher academic self-concepts which predicted higher grades. While there are no significant mean gender differences in IP, these findings suggest that IP plays a more important role in academic achievement for women than men.

September et al. (2001) studied 379 university students and found that people with higher scores for impostor feelings (and lower scores for ability confidence) score lower for self-acceptance. McGregor, Gee & Posey (2008) explored this relationship further by examining if the negative thought patterns and self-doubt associated with the impostor phenomenon are similar to the negative thought patterns and self-doubt that many individuals with mild depression experience. They found a positive correlation between the impostor phenomenon (IP) and Beck Depression Inventory (BDI-II) scores.

Impostor Phenomenon and Race/Ethnicity

More recent studies identified race/ethnicity as a possible predictor of impostor feelings and low self-esteem. Peteet, Montgomery, and Weekes (2015) studied 161 academically successful Black and Hispanic college students to examine predictors of IP. The results revealed that low psychological well-being and low ethnic identity are predictors of IP for both racial-ethnic groups. While this further supports the hypothesis that IP and psychological well-being are correlated, it did not clear up whether IP predicts psychological well-being or vice versa. This study, like other studies done on IP and racial minorities, used unreliable samples or failed to analyze group differences by combining different minority groups into one large minority group, so the generalizability

of these findings is weak.

Other research corroborates these findings. Peteet, Brown, Lige, and Lanaway (2015) found that for African American students, higher impostorism predicts higher psychological distress and lower self-esteem. Cokley et al. (2013) expanded research on IP and students of color to find out if there are differences among ethnic minority students in minority status stress, impostor feelings, and mental health. The authors studied a sample of 240 ethnic minority college students and found that African Americans reported higher minority status stress than Asian Americans and Latino/a Americans, whereas Asian Americans reported higher impostor feelings. This study also identified minority status stress and impostor feelings as predictors of psychological distress and well-being. However, impostor feelings were stronger predictors of mental health than minority status stress.

Cokley et al. (2017) conducted another study examining a more complex relationship. This study aimed to look at impostor feelings as a moderator and mediator of the relationship between perceived discrimination and mental health among racial/ethnic minority college students. In a sample of 106 African Americans, 102 Asian Americans, and 108 Latino/a Americans at an urban public university, data revealed that among African American students, high levels of impostor feelings moderated the perceived discrimination and depression relationship and mediated the perceived discrimination and anxiety relationship. For Asian American students, impostor feelings mediated the relationship between perceived discrimination and both depression and anxiety. Among Latino/a American students, low levels of impostor feelings moderated the relationship between perceived discrimination and both depression and anxiety, and partially mediated the relationship between perceived discrimination and anxiety. The authors also noted that multigroup path analyses revealed a significantly stronger impact of impostor feelings on depression among African American students and a stronger impact of perceived discrimination on impostor feelings among African American and Latino/a American students.

Lige, Peteet, and Brown (2017) examined the mechanisms of the relationship between racial identity, self-esteem, and IP more closely to find there may be a more complex dynamic happening. Controlling for the mediating variable self-esteem, the direct effect of racial identity on IP was not significant. This suggests that racial identity alone may not be sufficient in reducing feelings of IP among African American students. The relationship between self-esteem, racial/ethnic identity, and IP is still undetermined. Looking at mediating and moderating relationships is worth exploring in future research.

Along with the psychological distress related to IP and low self-esteem, minority students also deal with race-related stress which has been linked to detri-

mental health outcomes such as depression, anxiety, and binge alcohol use (Blume et al., 2012). This compounding stress suggests the need for more research on the impact of IP and self-esteem on marginalized populations.

Another vulnerable population to impostor syndrome is first-generation college students. Various studies found a relationship between first-generation status and impostor feelings which also lead to negative mental health and achievement outcomes (Majer, 2009; Von Robertson, Mitra, & Van Delinder, 2005; Wang & Castañeda-Sound, 2008). Bennett and Okinaka (1990) suggest first-generation students experience college differently depending on their race/ethnicity. Their study of first-generation students of color measured students' satisfaction with their campus and their feelings of social alienation, and they found the least satisfied and most alienated students of color drop out. Johnson et al. (2014) found that observations and encounters of racism and discrimination on campus increases academic environment stress which also impacts decisions for persistence.

Students of Color at Predominantly White Institutions

This research suggests another important caveat to consider is the moderating impact that the context of a predominantly white institution may have on self-esteem and feelings of impostorism on students of color. Cress and Ikeda (2003) noted that a negative campus climate is linked to student depression which is correlated with academic disengagement. To examine the impacts of feelings of alienation, Loo and Rolison (1996) used Tinto's (1975) definition of alienation— "the outcome of one's holding values highly divergent from those of the social collectivity and insufficient personal interactions with other members of the collectivity" (p. 91). Alienation, according to this definition, can occur in both the academic and social subsystems. Their research found that although academic excellence and accessible or supportive faculty contribute to satisfaction with the academic institution, ethnic minority students can still feel socio-culturally alienated. This suggests that unlike white students, ethnic students' retention rates may be just as much a function of sociocultural alienation as of academic factors. Hussain and Jones (2021) found that experiences of discrimination and bias contribute to a diminished sense of belonging to the college for students of color and this is more likely to be experienced by students at PWI. Other studies also suggest that a negative racial climate has a harmful effect on minoritized students (Harper & Hurtado, 2007; Kotori & Malaney, 2003; Williams et al., 1997).

FUTURE DIRECTIONS

Future studies should consider using an intersectional framework to clear inconsistent findings regarding the relationship between racial/ethnic identity, impostor phenomenon and self-esteem, especially as it pertains to first-generation women of color. More specifically, testing racial/ethnic identity as a mediating or moderating variable may provide a better understanding of the dynamics between these psychosocial phenomena and demographic characteristics. Specific research questions to consider include the following:

1. Are there differences among college women of color in impostor feelings and self-esteem attending predominantly white universities?
2. Does racial/ethnic identity moderate or mediate the relationship between impostor feelings and self-esteem?

Researchers may also consider using existing scales such as the Rosenberg Self-Esteem Scale, the Clance Impostor Scale, and Phinney's Multigroup Ethnic Identity Measure (MEIM) to measure the variables in this relationship ethnic identity. Using these scales will be helpful in ensuring face validity as well as high concurrent validity.

Universities and other social institutions should also consider ways to mitigate the detrimental effects of low self-esteem and impostor phenomenon on first-generation students of color. Extant research suggests two main protective factors that buffer the effects of low self-esteem and IP— a strong racial/ethnic identity and social support.

For instance, in a study of 3,282 university students, Bracey, Bámaca, and Umaña-Taylor used Phinney's Multigroup Ethnic Identity Measure (MEIM) to measure ethnic identity. The researchers found a significant, positive relationship between ethnic identity and self-esteem for all groups. This indicates that adolescents who score highly on ethnic identity also tend to demonstrate higher levels of self-esteem. Jaret and Reitzes (2009) expanded this research to look at the relationship between college student identities and ethnic identities on self-esteem, self-efficacy, and grade point average. This research revealed more about the consequences of feeling disconnected from one's racial identity in a college setting. Students who feel more estranged from their own group have lower self-esteem than those who do not feel estranged from it. This, and other research defining the impostor phenomenon suggests that self-esteem and self-efficacy is not a direct result of achievement, but rather, a phenomenon shaped by other sociocultural factors such as racial identity. Peteet, Montgomery, and Weekes (2015) examined racial identity and its effect on the impostor phenomenon, specifically. Using Phinney's (1989) MEIM, the authors found results that agreed with prior literature. Analysis showed the less an individual

felt a sense of belonging to their racial or ethnic group, the more likely they are to report low psychological well-being and high levels of IP. When synthesizing the research done on IP, self-esteem, and racial identity it is clear that racial identity plays a crucial role. In their research on African American college students, Bernard, Hoggard, and Neblett (2018) suggest racial identity is a moderating variable and found that racial discrimination predicts higher subsequent levels of IP, and racial identity acts as a protective barrier against IP. Having a positive image toward oneself and one's ethnic group can mitigate the development and internalization of feelings and messages of inferiority fueled by discriminatory encounters. This research not only finds IP is influenced by racial discrimination experiences as well as by the significance and meaning that individuals ascribe to being African American, but also reinforces the link between self-esteem, IP, and race/ethnicity. It should be noted that this study focused primarily on African-American female college students attending a PWI, meaning it may not generalize beyond the sample. Studies with larger sample sizes and a multiracial, multiethnic approach would greatly inform extant research on this topic and allow for a better understanding of the various protective factors against low self-esteem and impostor feelings in college students of color.

Social support via family, peers, and faculty also acts as a protective barrier against low self-esteem and self-efficacy, especially for first-generation students and students of color. In their study of students of color at a four-year PWI, Hussain and Jones (2021) found that discrimination and bias contribute to diminished sense of belonging to the college for students of color, especially Black students. However, frequent diverse peer interactions buffer against the effects of experiences of discrimination and bias on sense of belonging for all students of color.

By examining self-esteem in a sample of 98 African American college students, Causey, Livingston, and High (2015) identified that social support and parental involvement are significant factors that contribute to the development of self-esteem in African American adults. Universities wishing to help first-generation students of color succeed in higher education may need to consider ways in which they can make their campus feel more welcoming and supportive.

CONCLUSION

The extant research on impostorism and low self-esteem in college students provides an abundance of information on which populations are most vulnerable to these psychosocial phenomena as well as the various detrimental effects

it can have. Still, there are inconsistencies amongst the various findings presented in this review of the literature which suggests a need for further exploration of the exact relationships between IP, self-esteem, racial/ethnic identity, and sex while also considering how students' experiences and environments may be key grounds for addressing the various mental health and academic achievement gaps associated with IP and self-esteem through policy.

REFERENCES

- Baker, C. N. (2015). Gender differences in the experiences of African American college students: The effects of co-ethnic support and campus diversity. *Women, Gender, and Families of Color*, 3(1), 36. <https://doi.org/10.5406/womgenfamcol.3.1.0036>
- Bennett, C., & Okinaka, A. M. (1990). Factors related to persistence among Asian, Black, Hispanic, and White undergraduates at a predominantly white university: Comparison between first and fourth year cohorts. *The Urban Review*, 22(1), 33–60. <https://doi.org/10.1007/BF01110631>
- Berkner, L., He, S., Cataldi, E. F., & Knepper, P. (2002). Descriptive summary of 1995-96 beginning postsecondary students: Six years later: Statistical analysis report. *PsycEXTRA Dataset*. <https://nces.ed.gov/pubsearch/pubinfo.asp?pubid=2003151>
- Bernard, D. L., Hoggard, L. S., & Neblett, E. W. (2018). Racial discrimination, racial identity, and impostor phenomenon: A profile approach. *Cultural Diversity and Ethnic Minority Psychology*, 24(1), 51–61. <http://dx.doi.org/10.1037/cdp0000161>
- Blume, A. W., Lovato, L. V., Thyken, B. N., & Denny, N. (2012). The relationship of microaggressions with alcohol use and anxiety among ethnic minority college students in a historically white institution. *Cultural Diversity and Ethnic Minority Psychology*, 18(1), 45–54. <http://dx.doi.org/10.1037/a0025457>
- Black identity and self-esteem: A review of studies of Black self-concept, 1968-1978 (1979). *Annual Review of Sociology*, 5(1), 53–74. <https://www.jstor.org/stable/2945947>
- Bracey, J. R., Bámaca M. Y., & Umaña-Taylor, A. J. (2004). Examining ethnic identity and self-esteem among biracial and monoracial adolescents. *Journal of Youth and Adolescence*, 33(2), 123–132. <http://pascal-francis.inist.fr/vibad/index.php?action=search&terms=15492992>
- Canning, E. A., LaCosse, J., Kroeper, K. M., & Murphy, M. C. (2019). Feel-

- ing like an imposter: The effect of perceived classroom competition on the daily psychological experiences of first-generation college students. *Social Psychological and Personality Science*, 11(5), 647–657. <https://doi.org/10.1177/1948550619882032>
- Causey, S. T., Livingston, J., & High, B. (2015). Family structure, racial socialization, perceived parental involvement, and social support as predictors of self-esteem in African American college students. *Journal of Black Studies*, 46(7), 655–677. <http://www.jstor.org/stable/24572913>
- Clance, P. R., & Imes, S. A. (1978). The impostor phenomenon in high achieving women: Dynamics and therapeutic intervention. *Psychotherapy: Theory, Research & Practice*, 15(3), 241–247. <http://dx.doi.org/10.1037/h0086006>
- Cokley, Kevin. (2001). Gender differences among African American students in the impact of racial identity on academic psychosocial development. *Journal of College Student Development*, 42.
- Cokley, K., McClain, S., Enciso, A., & Martinez, M. (2013). An examination of the impact of minority status stress and impostor feelings on the mental health of diverse ethnic minority college students. *Journal of Multicultural Counseling and Development*, 41(2), 82–95. <https://doi.org/10.1002/j.2161-1912.2013.00029.x>
- Cokley, K., Awad, G., Smith, L., Jackson, S., Awosogba, O., Hurst, A., Stone, S., Blondeau, L., & Roberts, D. (2015). The roles of gender stigma consciousness, impostor phenomenon and academic self-concept in the academic outcomes of women and men. *Sex Roles*, 73(9-10), 414–426. <https://doi.org/10.1007/s11199-015-0516-7>
- Cokley, K., Awad, G., Smith, L., Jackson, S., Awosogba, O., Hurst, A., Stone, S., Blondeau, L., & Roberts, D. (2017). Impostor feelings as a moderator and mediator of the relationship between perceived discrimination and mental health among racial/ethnic minority college students. *Journal of Counseling Psychology*, 64(2), 141–154. <https://doi.org/10.1037/cou0000198>
- Cress, C. M., & Ikeda, E. K. (2003). Distress under duress: The relationship between campus climate and depression in Asian American college stu-

- dents. *NASPA Journal*, 40(2), 74–97. <http://archives.pdx.edu/ds/psu/9192>
- Crocker, J., & Major, B. (1989). Social stigma and self-esteem: The self-protective properties of stigma. *Psychological Review*, 96(4), 608–630. <https://doi.org/10.1037/0033-295X.96.4.608>
- Ethier, K. A., & Deaux, K. (1994). Negotiating social identity when contexts change: Maintaining identification and responding to threat. *Journal of Personality and Social Psychology*, 67(2), 243–251. <http://pascal-francis.inist.fr/vibad/index.php?action=search&terms=4191212>
- Harper, S. R., & Hurtado, S. (2007). Nine themes in campus racial climates and implications for institutional transformation. *New Directions for Student Services*, (120), 7–24. <http://dx.doi.org/10.1002/ss.254>
- Hope, E. C., Chavous, T. M., Jagers, R. J., & Sellers, R. M. (2013). Connecting self-esteem and achievement: Diversity in academic identification and dis-identification patterns among Black college students. *American Educational Research Journal*, 50(5), 1122–1151. <https://www.jstor.org/stable/23526125>
- Hussain, M., & Jones, J. M. (2021). Discrimination, diversity, and sense of belonging: Experiences of students of color. *Journal of Diversity in Higher Education*, 14(1), 63–71. <http://dx.doi.org/10.1037/dhe0000117>
- Jaret, C., & Reitzes, D. C. (2009). Currents in a stream: College student identities and ethnic identities and their relationship with self-esteem, efficacy, and grade point average in an urban university.” *Social Science Quarterly*, 90(2), 345–67. <https://www.jstor.org/stable/42940591>
- Johnson, D. R., Wasserman, T. H., Yildirim, N., & Yonai, B. A. (2013). Examining the effects of stress and campus climate on the persistence of students of color and White students: An application of Bean and Eaton’s psychological model of retention. *Research in Higher Education*, 55(1), 75–100. <https://doi.org/10.1007/s11162-013-9304-9>
- Kelly, P. J. (2005). As America becomes more diverse: The impact of state higher education inequality. *National Center for Higher Education Management Systems*. <http://hdl.handle.net/10919/83132>

- Kotori, C., & Malaney, G. D. (2003). Asian American students' perceptions of racism, reporting behaviors, and awareness of legal rights and procedures. *NASPA Journal*, 40(3), 56–76. <https://doi.org/10.2202/0027-6014.1254>
- Lige, Q. M., Petee, B. J., & Brown, C. M. (2016). Racial identity, self-esteem, and the impostor phenomenon among African American college students. *Journal of Black Psychology*, 43(4), 345–357. <https://doi.org/10.1177/0095798416648787>
- Lin, S. A. (2008). *The impostor phenomenon among high-achieving women of color: Are worldview, collective self-esteem and multigroup ethnic identity protective?* (Publication No. 3303094) [Doctoral dissertation, Fordham University]. ProQuest Dissertations and Theses Global.
- Loo, C. M., & Rolison, G. (1986). Alienation of ethnic minority students at a predominantly White university. *The Journal of Higher Education*, 57(1), 58. <https://doi.org/10.2307/1981466>
- Majer, J. M. (2009). Self-efficacy and academic success among ethnically diverse first-generation community college students. *Journal of Diversity in Higher Education*, 2(4), 243–250. <https://doi.org/10.1037/a0017852>
- McGregor, L. N., Gee, D. E. , & Posey, K. E. (2008). I feel like a fraud and it depresses me: The relation between the impostor phenomenon and depression. *Social Behavior and Personality: an International Journal*, 36(1), 43–48. <https://doi.org/10.2224/sbp.2008.36.1.43>
- Peteet, B. J., Brown, C. M., Lige, Q. M., & Lanaway, D. A. (2014). Impostorism is associated with greater psychological distress and lower self-esteem for African American students. *Current Psychology*, 34(1), 154–163. <https://doi.org/10.1007/s12144-014-9248-z>
- Peteet, B., Montgomery, L., & Weekes, J. (2015). Predictors of impostor phenomenon among talented ethnic minority undergraduate students. *The Journal of Negro Education*, 84(2), 175. <https://doi.org/10.7709/jnegroeducation.84.2.0175>
- Phinney, J. S. (1989). Stages of ethnic identity development in minority group adolescents. *The Journal of Early Adolescence*, 9(1-2), 34–49. <https://doi.org/10.1177/08912408910000090102>

- doi.org/10.1177/0272431689091004Porter, J. R. & Washington, R. E. (1979). Porter, J. R. & Washington, R. E. (1993). Minority identity and self-esteem. *Annual Review of Sociology*, 19(1), 139–161. <https://doi.org/10.1146/annurev.so.19.080193.001035>
- Rosenberg, M., Schooler, C., Schoenbach, C., & Rosenberg, F. (1995). Global self-esteem and specific self-esteem: Different concepts, different outcomes. *American Sociological Review*, 60(1), 141. <https://doi.org/10.2307/2096350>
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Wesleyan University Press.
- Rumbaut, R. G. (1994). The crucible within: Ethnic identity, self-esteem, and segmented assimilation among children of immigrants. *International Migration Review*, 28(4), 748. <https://doi.org/10.2307/2547157>
- Sellers, R. M., Smith, M. A., Shelton, J. N., Rowley, S. A. J., & Chavous, T. M. (1998). Multidimensional model of racial identity: A reconceptualization of African American racial identity. *Personality and Social Psychology Review*, 2(1), 18–39. https://doi.org/10.1207/s15327957pspr0201_2
- September, A. N., McCarrey, M., Baranowsky, A., Parent, C., & Schindler, D. (2001). The relation between well-being, impostor feelings, and gender role orientation among Canadian university students. *The Journal of Social Psychology*, 141(2), 218–32. <http://pascal-francis.inist.fr/vibad/index.php?action=search&terms=1001290>
- Shahid, N. N., Nelson, T., & Cardemil, E. V. (2017). Lift every voice: Exploring the stressors and coping mechanisms of Black college women attending predominantly White institutions. *Journal of Black Psychology*, 44(1), 3–24. <https://doi.org/10.1177/0095798417732415>
- Tafarodi, R. W. & Swann, W. B., Jr. (1995). Self-linking and self-competence as dimensions of global self-esteem: Initial validation of a measure. *Journal of Personality Assessment*, 65(2), 322–42. https://doi.org/10.1207/s15327752jpa6502_8

- Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45(1), 89–125. <https://doi.org/10.2307/1170024>
- Von Robertson, R., Mitra, A., & Van Delinder, J. (2005). The social adjustment of African American females at a predominantly White Midwestern university. *Journal of African American Studies*, 8(4), 31–45. <https://www.jstor.org/stable/41819067>
- Wang, C. C. D. C., & Castañeda-Sound, C. (2008). The role of generational status, self-esteem, academic self-efficacy, and perceived social support in college students' psychological well-being. *Journal of College Counseling*, 11(2), 101–18. <https://doi.org/10.1002/j.2161-1882.2008.tb00028.x>
- Williams, D. R., Yu, Y. Jackson, J. S., & Anderson, N. B. (1997). Racial differences in physical and mental health. *Journal of Health Psychology*, 2(3), 335–351. <https://doi.org/10.1177/135910539700200305>

When Once Upon a Time Was Real: Discovering Accurate Piracy in Children's Literature and Curriculum

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Abstract

Piracy was once known and remembered as a treacherous and terrifying act in the Caribbean. As these bands of thieves and killers, hungry for the temporary pleasures of life, plundered the surrounding nations, devastation, and fear filled the lives of many who lived near these coastal regions. These feared pirates that lived and plundered for centuries have become romanticized images that take over Halloween stores, Disney films, birthday parties, and children's books. The idolized pirate naturally becomes geared towards children. This paper will look at romanticized pirate literature as well as accurate pirate literature that can be present in classrooms today to give children the opportunity to live in a completely different universe yet simultaneously learn about the heavy history that impacted the seas long ago. In addition, this paper will provide teachers and parents alike curriculum opportunities to teach children about accurate piracy by technology. Through this paper, educators will have the ability to recognize the moments when children can live in fantasy and the moments when children can learn a new piece of history so that piracy is not a discouraging topic, but an enhanced one.

INTRODUCTION

The largest imaginations currently belong to the future generation of world changers. They are the ones sitting in classrooms for eight hours a day, learning about how small numbers can combine to make bigger numbers, how atoms separate our bodies from the seats we sit in, how commas change the meanings of sentences, and how America gained its independence. They are also the ones who may play cops and robbers or fashion studio at recess and maybe, just maybe, might make finger paintings of turkeys at Thanksgiving. Yes, there will continue to be children who live in their imaginations and make life more exciting. It will continue to be children who take these imaginations and make them into real displays of color as they change the world.

Many of these creative minds are fueled within the classroom through literature; it is imperative that both the educator and the parent alike provide both accurate and fictional sources of common literary themes for kids. This is because children need to be able to live in a world outside of reality where they can grow, think, explore, and learn (for the sake of this paper, this will be labeled as fictional literature). Likewise, children need to be able to learn accurate information so that they can better analyze and draw conclusions regarding different topics, especially if such topics relate to things that can be found either in history or today (this will be labeled as nonfiction literature).

There are still some nonfiction topics today that have been romanticized to the point that they have become strictly fictionalized for the imagination of kids. One such example claimed as being romanticized and fictionalized, taking away all historically accurate information in children's literature today, is piracy. Yes, pirates. The ones found in *Peter Pan*, *Pirates of the Caribbean*, *Treasure Island*, and more. The same pirates illustrated in books and movies wearing eye patches, shouting "argh!," and making prisoners walk the plank. Although pirates in literature are quite appealing, most elementary-aged books depict pirates as briefly described earlier. All good fun, however, far from accurate.

Seeing that piracy was a very real and scary historical event that continues to be a very real threat today (although not as widely known), it is shocking that children are not provided with enough resources in their reading time that accurately point to what piracy was and is, as this subject is of interest to them. In fact, anything related to survival happens to spark many kids' interest in a unique way. Mary Anne Lindberg states in her article, "Survival Literature in Children's Fiction" that, "Children like to be busy, always doing something, and characters fighting for survival are constantly involved with the puzzle of solving basic problems with minimal equipment and supplies. The reader feels

great satisfaction as he vicariously works out ingenious solutions to the problems present.”¹ The purpose of this paper is to point out how piracy became romanticized, the specific ways that piracy is portrayed inaccurately in literature, and what educators can do to add historically accurate pirate literature and curriculum to their classrooms.

A BRIEF HISTORY OF PIRACY AND ITS JOURNEY TO ROMANTICISM

Piracy in the fifteenth through twentieth centuries was common in many forms: from the conquistadors of countries such as Mexico and the Dominican Republic (yes, Christopher Columbus was a pirate to everyone but the country he sailed for), to the ruthless and relentless sailors on the seas such as Blackbeard and Sir Francis Drake. Piracy was not a fun hobby, but a rather terrifying career resulting in thousands of horrific deaths as pirates raided and captured loot and people both by land and sea. In fact, it was quite normal for pirates to plunder a town, then burn it to the ground, killing individuals along the way and taking others to be slaves or prized possessions. For some, it was much simpler, and the very sight of their flag would cause ships to surrender.

This lifestyle would be the result of an unquenched greed for materialized possessions. As gold and silver were discovered more and more, nation turned against nation, and thus piracy became more widely used. It would be a spiraling of events that would create such an explosion in piracy. Imperialism would create a global competition to gain more land. This would lead to the obliteration of many powerful and famous ancient nations and the deaths of thousands of individuals. The competition would continue as gold and silver were then brought back to Europe and countries fought each other for the ultimate position of power and prestige. When government-issued pirates became illegal, many sailors were left without a job and thus piracy continued to increase in the seas. In no way was this life a glamorous one, and in no way were pirates charming individuals. Instead, they were merciless in every sense of the word. This pre-romanticized truth of piracy is not commonly written in children’s literature today and thus the terrifying events are not often noted. Instead what is left between the pages in elementary classroom novels is a pirate with a soft heart or an easy defeat. In Marcus Rediker’s article, “Under the Banner of King Death,” he discusses what the true ruthlessness of a pirate was like. In a truthful recount of a captain captured by pirates, he states that:

“In July, Thomas Fox, a Boston ship captain, was taken by pirates who “Questioned him whether anything was done to the Pyrates in Boston Goall,” prom-

1. Mary Anne Lindberg, “Survival Literature in Children’s Fiction,” *Elementary English* 51, no.3 (1974): 330, <https://www.jstor.org/stable/41387166>.

ising “that if the Prisoners Suffered, they would Kill every Body they took belonging to New England.” Shortly after this incident, Teach’s sea-rovers captured a merchant vessel and, “because she belonged to Boston, [Teach] alledging the People of Boston had hanged some of the Pirates, so burnt her.” Teach declared that all Boston ships deserved a similar fate.”²

Rediker shows how true piracy was conducted: many threats, many captures, and many deaths. This type of writing is a stark contrast to the way pirates are drawn up in the most famous children’s books. Although pirates are often written as the antagonist, burning vessels, killing citizens, and threatening prisoners are not common themes (and rightfully so). Many educators and parents are not in support of providing literature to young children full of gore and grief. Thus, it makes sense why this romanticized version of pirates has become so mainstream today. However, the fictionalized life and the actual history of piracy are quite different and if pirates are common literary themes among children’s books, it is important to provide some accurate depictions of pirates in the books provided to students.

Nevertheless, the question remains of how pirates became so romanticized. Truly, it starts in England. British writers, during the age of piracy, wanted to make their writing appear more expressive and gripping, and, if pirates were involved, accuracy became muddled with fantasy. Sea adventures became daring voyages and treasure became a buried game of Clue. Robert Gordon Dryden writes in “Successful Pirates and Capitalist Fantasies”, “The pirate of the English imagination is a product of English nationalism; he is alternately defiant, compliant, a student, and a teacher of English ideology, trade, and colonial conquest, and as such, he eventually becomes the rightful inheritor of English wealth and power, a legitimate and respected member of polite English society.”³ What Dryden is saying is that English writers began to write from a fictionalized standpoint based on very real, prevalent events of the time. Piracy was well known to all of Europe during the seventeenth century and was a constant source of depletion in the new Western world. English writers took what they knew, the effects of piracy, and used it to immediately connect with their readers. In addition, writers did what they did best by creating a world where perhaps piracy was a braver act. Perhaps the life of a pirate hypothetically could be exciting. The rapid change in piracy from a terrible criminal act and way of life to an expedition of treasure and mystery becomes logical when the

2. Marcus Rediker, “‘Under the Banner of King Death’: The Social World of Anglo-American Pirates, 1716 to 1726,” *The William and Mary Quarterly* 38, no. 2 (1981): 220.

3. Robert Gordon Dryden, “Successful Pirates and Capitalist Fantasies: Charting Fictional Representations of Eighteenth- And Early Nineteenth-Century English Fortune Hunters” (Doctoral Dissertation, Louisiana State University, 2000), 2.

factors are considered.

Additionally, some of the most popular pirate fiction books were written by past pirates and sailors themselves. Pirates such as Defoe would be rumored to end up writing books such as *A General History of the Robberies and Murders of the Most Notorious Pirates*,⁴ which would bring fact and fiction together to create an all-around romanticized book to enjoy. Although at the time, this book was written under a pseudonym. It would be discovered much later who the actual writer was rumored to be. Since actual pirates of the time were writing fiction novels as well, it only fueled the romanticized pirate life more. Defoe's writing is a perfect example of such. Joshua Grasso states in "The Providence of Pirates: Defoe and the True Bred Merchant", "What is notable is that Defoe continually refrains from typical pirate violence to find a bloodless— if occasionally blood curdling— solution."⁵ The romanticized pirate life so common today in society and in children's literature starts from a very real reason to use what was known and create a separate world from it. This would result in some of the most popular children's novels even today, such as *Peter Pan* and *Treasure Island* and would influence current writing such as *The Magic Treehouse: Pirates Past Noon*. It is important to note that not all children's books today are fiction. In fact, several books available today are accurate sources about piracy and ones that should be encouraged both at home and in the elementary classroom. However, popular sources of fictionalized children's pirate books should be discussed first to understand what the fictionalized elements are and when is an appropriate time to use them within the classroom.

FICTIONAL PIRATE BOOKS PRESENT IN THE ELEMENTARY CLASSROOM

The Magic Treehouse: Pirates Past Noon is one fictionalized story that is recommended to all educators teaching grades 1–3.⁶ Not many fictionalized books have some elements of truth within them and Mary Pope Osborne, the author of this historically creative series, does such. In this specific novella, siblings Jack and Annie get stuck running from pirates. To finally go home and make it back to the Magic Treehouse, they must help the pirates discover the buried treasure.

Osborne combines the rumors about one real pirate and uses them to create a fictionalized portrait of piracy for kids. In all other circumstances, things like

4. Charles Johnson, *A General History of the Robberies and Murders of the Most Notorious Pirates* (Britain: Charles Rivington, 1724).

5. Joshua Grasso, "The Providence of Pirates: Defoe and the 'True-Bred Merchant,'" *Digital Defoe: Studies in Defoe & His Contemporaries* 2, no. 1 (2010): 30.

6. Mary Pope Osborne and Sal Murdocca, *Pirates Past Noon* (New York: The Random House, 1994).

buried treasure were not accurate in the Golden Age of Piracy. Many pirates would spend all their collected booty by the time the thought of hiding it would have occurred. However, Osborne is doing something interesting by making this specific book about the buried treasure of Captain William Kidd, an actual pirate who was rumored to have buried a small portion of treasure in his lifetime. Using these events, Osborne creates a story where Jack and Annie must find Kidd's treasure. Throughout the novella, Jack references his handy history book (ultimately for the young reader) to gain a better sense of the history of this pirate. In addition, Osborne includes a small paragraph at the beginning of the novella to clarify that not everything within this children's book is historically accurate.

Although this is most definitely identified as a fictionalized pirate tale, this is one of the few pirate books recommended for educators and parents to include for children reading at a Lexile Level 490L. The Lexile score is commonly used among most schools within the U.S. and is used to find books that extend a child's reading skills within their instructional level.⁷ For classroom teachers specifically, Osborne has a nonfiction book specifically about piracy that is meant for children to read after they have finished the first novella. In *Magic Treehouse Fact Tracker: Pirates*, Osborne digs into the actual history of piracy so that students gain a full perspective of who pirates really were.⁸ What is great is this book is also meant for children at a slightly higher Lexile Level (770L).

Before proceeding, it should be mentioned that just because a pirate book is fictional, does not mean that it should not be in the elementary classroom. The pirate books highlighted within this paper are meant to encourage educators and parents to provide more nonfiction resources to their children so that things such as romanticized piracy, as defined within this paper thus far, are not heightened. One example of a phenomenal children's book, starting as a play, that shines a romanticized light on piracy yet is still a work of literary importance is *Peter and Wendy*, also known as *Peter Pan*, by James Matthew Barrie.⁹ The beloved Peter Pan paints their antagonist, Captain Hook, as the ultimate pirate nemesis.

Although Barrie is portraying a feared pirate, every aspect of Hook is fictionalized. The well-known story of Peter Pan incorporates Hook as the antagonist who refuses to leave Neverland until he gets revenge on Peter Pan. This revenge is because Peter fed Hook's left hand to a crocodile, and thus Captain Hook now wears a hook in its place (shocker). Because Barrie's play and later

7. "What are Lexile Student Measures by Grade?" Lexile & Quantile Tools.

8. Will Osborne and Mary Pope Osborne, *Magic Tree House Fact Tracker: Pirates* (New York: Random House Books for Young Readers, 2012).

9. James Matthew Barrie, *Peter and Wendy* (New York: Simon & Schuster, 1911).

children's novel had such great success among kids, Disney would later pick up the book as a movie, and the famous Captain Hook would go on to be romanticized through multiple movie depictions, theatrical depictions, and even musical depictions. From this successful children's book came the beginning of a romanticized pirate image that would remain prevalent for young children even today. However, it would not be Barrie who would portray a highly romanticized version of Hook, but Disney.

For this reason, with big names such as Disney being a huge influencer for kids, if a romanticized version of a pirate becomes so famous that the character is portrayed for generations to come, the issue of romanticized piracy will only continue in children's literature and media. If this book is to be used in the classroom, it should be known and labeled as completely fictional for children. In addition, if books like Peter Pan are present, it is also a wise option to incorporate nonfiction pirate texts as well. The book sits at a Lexile 500L-800L reading level, meaning this book is suitable for children in grades 3rd-6th. The inspiration for the creation of Captain Hook is unknown, but, during this time, the most famous children's novel that had been published prior to Barrie's play would be *Treasure Island*.

Treasure Island by Robert Louis Stevenson is by far the most popular pirate novel to spark inspiration for future pirate literature.¹⁰ It is one of the oldest and most famous fictional pirate novels and would continue to be portrayed in movie depictions, theatrical depictions, and even as the name of a famous fast-food restaurant chain, Long John Silver's. *Treasure Island* is the tale of a young boy, John Hawkins, who sets sail with his companions and a set of hired crew to find the buried treasure of Captain Flint. Upon their journey, Hawkins realizes that Long John Silver (the ship's cook) and the rest of the hired crew are all pirates and intend on taking the treasure for themselves. Along the way, Hawkins will meet another ex-pirate marooned on an island. It is here that Hawkins will have to face one of the most notorious pirates and use trick and wit to outsmart him. Long John Silver and the rest of the pirates mentioned in this children's chapter book are all highly romanticized versions of pirates. Yes, they are terrifying to read about but it is the small details that make up these characters and will paint an inaccurate picture of piracy in young minds such as buried treasure, walking the plank (something that Stevenson created), and the overuse of the word "arrgh!" Monica F. Cohen writes in her article, 'Imitation Fiction: Pirate Citings in Robert Louis Stevenson's *Treasure Island*:

...the two literary ancestors most influential in the writing of Treasure Island were the novelists Daniel Defoe and Sir Walter Scott, both of whom

10. Robert Louis Stevenson, *Treasure Island* (New York: Macmillan Company, 1902).

had personal experiences with real pirates. Having spent a fortune on marine insurance, Defoe ultimately faced bankruptcy due in part to piracy at sea; he had witnessed the corpses of real pirates downloaded from pirates, such as that of Captain Kidd, displayed on Execution Dock; he knew former pirates in London, including the beggar named Israel Hands whom Stevenson would later resurrect for service on the good ship Treasure Island. (155-156)¹¹

Cohen brings attention to the fact that most of the fictionalized portions of piracy that make up these famous characters were just pieces taken from several famous pirate resources available in England prior to that time. It is important to note that Stevenson was Scottish, and when he published this novel, piracy had ended recently in Europe's history. This makes sense as to why the Scottish writer, as well as many other writers of his day, would have taken a topic so familiar to Europe at this time and used it to create a romanticized version for kids. *Treasure Island* has a Lexile reading level of 900L-1060L, however there are versions of the tale that have been shortened for younger readers at a 400L Lexile reading level. As was true for *Peter Pan*, the same applies here. *Treasure Island* is an incredible fiction piece to have in the classroom, but it is encouraged for educators and families to carry nonfiction pirate books as well.

One recent pirate novel that has made its way to classrooms today is *Race to the Bottom of the Sea* by Lindsay Eagar.¹² In this futuristic children's novel with a hint of historical fiction, 11-year-old Fidelia is captured by the pirate Merrick the Monstrous. Captain Merrick knows that she is smart and innovative and wants her to use her inventing skills to help him find his treasure at the bottom of the ocean floor. This romanticized pirate Merrick cannot be identified with a specific time period. This small factor is different from any other children's novel discussed thus far because what Eagar has created is the opportunity for the student to imagine piracy being alive today. This concept is beneficial for students who would be interested in doing research on nonfiction piracy, because piracy is still an active lifestyle. Although not popular in most places across the globe, piracy is still a famed way of life in North Africa and Asia. Many adults can recall the famed *Captain Phillips* movie that discusses the true story of Richard Phillips who was captured and held at ransom by Somali pirates in 2009. Shatakshi Johri and S. Krishnan state in their article, "Piracy and Maritime Security":

Modern day pirates may not possess the fictional characteristics of historical

11. Monica Feinberg Cohen, ., "Imitation Fiction: Pirate Citings in Robert Louis Stevenson's 'Treasure Island.'" *Victorian Literature and Culture* 41, no. 1 (2013): 155-156.

12. Lindsay Eagar, *Race to the Bottom of the Sea* (Massachusetts: Candlewick Press, 2017).

*pirates, but piracy does exist and has become a thriving business making millions annually from the increasing amount of ransom paid and \$18 million in 2010 from Somali piracy alone, according to a 2013 World Bank Report. (81)*¹³

Eagar's children's novel is one recommended for classroom use because although it is fictional, it does spur the child to imagine the scenario being alive and real today. The chances of a child reading more about piracy today on trusted sites increases in the classroom as well. The book is written at a Lexile reading level of 810L, meaning that children in grades 4th and up are mature enough to understand the vocabulary and literary terms.

One literary genre that has been sweeping children's fiction in recent years is graphic novels. The use of graphic novels in classrooms and at home has become almost religious as many students who once struggled with the enjoyment of reading now are reading more books than ever before. They are different and visually representative, usually filled with action and sometimes relatable. *Red Seas Volume One Under the Banner of King Death* written by Ian Edgington is one such graphic novel that happens to include piracy.¹⁴ Instead of creating a romanticized version of piracy, Edgington stays fairly true to how a person would have joined the pirate life. He even keeps the Spanish as a main country/fleet to attack, however his work becomes incredibly fictionalized based on its supernatural characteristics. Yes, in this pirate graphic novel, these pirates meet up with a zombie pirate crew after the discovery of clues to an ancient tomb that were hidden within the Spanish plunder. Edgington combines little bits of pirate history with graphic novel fan fiction and sci-fi to create a novel that gets kids reading and possibly interested in piracy. Although very fictionalized, Edgington does have the power of getting a curious young reader interested in accurate piracy. In fact, a child might have learned a few accurate things about piracy within his novel (uncommon to see in pirate fiction). In addition, if a student were to read Edgington's work, it would be easy for an educator to introduce some of the nonfiction pirate books discussed later.

Although fictional piracy books have shaped the way students view piracy today, it is also important from an educator or family standpoint to try and incorporate nonfiction pirate texts that engage kids and encourage them to do further research and learning on their own. In addition, especially for elementary school teachers, it is quite easy to integrate the pirate curriculum into the Common Core standards for students each year in all grade levels.

13. Shatakshi Johri and S. Krishnan, "Piracy And Maritime Security: Regional Characteristics and Political, Legal and Economic Implications," *World Affairs: The Journal of International Issues* 23, no. 3 (2019): 81.

14. Ian Edgington, *The Red Seas: Under the Banner of King Death* (Oxford: Rebellion Publishing, 2005).

WAYS TO INCORPORATE ACCURATE PIRACY IN LITERATURE AND CURRICULUM

Pirateology: The Pirate Hunters' Companion by Dugald Steer featuring Captain William Lubber's journal and other documents is one of the most creative blends of fiction and nonfiction pirate texts made for kids.¹⁵ This resource uses a fictional pirate character to recount the accurate pieces of pirate history. This interactive book allows for kids to learn about everything from pirate clothing, pirate weaponry, famous pirates, and more. What is great about this resource is that students can easily look through these pages while still reading any piece of fictional piracy at the same time. This book is not necessarily one for educators to score reading accuracy, but it is a helpful resource for kids of all ages to study and examine. The Lexile reading level is 1180L and is meant for more advanced readers. However, some kids starting in grade three can easily use this book to admire the illustrations and images of accurate piracy to gain a better understanding of its history.

Pirates and *Pirates Most Wanted* by John Matthews are two additional sources recommended for students who wish to have a deeper understanding of accurate piracy in world history. These two sources by Matthews are the two that should be recommended the most to all educators and families as they not only are visually pleasing, but are both chock-full of helpful information for kids to better understand what piracy was like during the Golden Age of Piracy in the 1700's. Matthews' first book discusses the general overview of this time period: from types of ships, to pirate flags, and the pirates' lives on board. If a child has never been exposed to specific pirate names, this would be a perfect place to start.¹⁶ Matthews' second book discusses the most notorious pirates known in history.¹⁷ These pirates' legacies and deaths are all recorded in this book and would be a perfect resource for kids who understand the basics of piracy and want to learn more about specific men and women. *Pirates* has a Lexile reading level of 1300L and *Pirates Most Wanted* has a Lexile reading level of 1220L. Although these reading levels are quite high, as mentioned earlier, both resources would be suitable for younger children as well. In terms of use in curriculum within the elementary classroom, Matthews' books would be more favored to use over Steer's as they provide extensive research and topics for educators to create lesson plans from.

For kids in grades 3rd-5th, the Who Was? series is a fantastic resource for students. Within this series are hundreds of short, nonfiction chapter books

15. Dugald Steer, *Pirateology: The Pirate Hunters' Companion* (Massachusetts: Candlewick Press, 2006).

16. John Matthews, *Pirates* (New York: Atheneum Books for Young Readers, 2006).

17. John Matthews, *Pirates Most Wanted* (New York: Atheneum Books for Young Readers, 2006).

that discuss a specific person in history. This series has several pirate and Viking figures, such as *Who Was Blackbeard?*¹⁸ by James Buckley Jr. and *Who Was Leif Erikson?*¹⁹ by Nico Medina. These books specifically discuss the full life, in depth, of the person the novella is about. Plus, these books are perfect for use in reading fluency exams and state testing prep.

In addition to pirate literature designed for students, it is easy for educators to incorporate accurate pirate web sources into their curriculum. These web sources are perfect for educators looking to add history lessons and reading exercises for their students. Likewise, the use of pirate sites allows students to interact with technology and gain practice with online research and web search (of course, supervised). The websites listed below, which will be analyzed further, are all safe sites that educators can securely use within their classroom.

The Queen Anne's Revenge website was created after Blackbeard's treasured sailing vessel was discovered at the bottom of the ocean floor in North Carolina.²⁰ The website not only has several articles about the history of Blackbeard, but also articles that trace the history of his ship and the current treasures that archeologists and scientists are still finding from the wreck. Not only that, but there lies one area within the website where students can watch videos, read articles, and see images of different elements of piracy that all trace back to Blackbeard's ship. Students can listen to a podcast all about the history of Blackbeard. They can scroll through the gallery of artifacts discovered on his ship so far. One area of the website allows for teachers and families to print out interactive pirate activities both at school and at home to gain even more knowledge about Blackbeard. It truly is a website for all ages. If students are using the website individually within class for research purposes, this website is best for grades 5th–8th. However, with adult assistance, this website can be easily accessible for kids in grades 3rd–4th as well.

The National Park Service also has a corner of their website dedicated to National Parks that are home to some of the most historic spots for past pirating and privateering.²¹ Students can click on the locations provided and get a detailed description about the place and how it relates to piracy. In addition, the National Park service has attached links for students to dig deeper and learn even more about piracy. This can be a great addition to classrooms and, for some locations, a fun challenge to bring home for families. National Parks have become a huge influence on families today through vacations and images and have made their way into the classroom as well. The reading level remains at

18. James Buckley, *Who Was Blackbeard?* (New York: Penguin Young Readers Group, 2015).

19. Nico Medina, *Who Was Leif Erikson?* (London: Penguin Young Readers Group, 2018).

20. Queen Anne's Revenge Project

21. "Ye Parks of Privates and Privateers," National Park Service.

a 5th-8th grade level, specifically due to research purposes, however, educators can encourage families with kids in younger grades to look over the website at home to learn more about a specific pirate location.

HomeSchoolMom, a website for parents beginning homeschooling for their children, provides one of the best A-Z pirate unit studies. This source is filled with curriculum, activities, and research objectives that educators and families can use for their kids to better understand the history of piracy. This website contains short documents about famous pirates, parts of a ship, popular weaponry, etc. as well as a detailed description of lesson plan ideas for teachers that pair with the short essays. In addition, The HomeSchoolMom website provides a separate page for students with multiple links to separate safe websites all about pirates through the ages.²² These curriculum pieces are best used for grades 4th-6th and are the best tools to use for those beginning an introduction to technology and research. When students must find the answers on their own based on the information given, it allows students to gain more independence and responsibility within their learning. Activities such as these can be used in the classroom for research practice and technology purposes, but also for history lessons and reading comprehension. Any of the websites mentioned can be used as fun, educational tools that students can have access to when reading any of the mentioned nonfiction pirate books.

CONCLUSION

The romanticized version of pirates has become the only version of piracy that young students are familiar with. Things like Disney movies have created a false representation of what some of the most terrifying people were like. From an educator's standpoint, if all other events and names in history are treated with such importance, piracy should too. It is common for elementary classrooms to carry nonfiction and fiction texts about major events and names from history, and it would bother the average teacher if students did not have those resources. If piracy had not been so romanticized over the years, perhaps it too would be treated as equally important as other historical figures discussed in classes. This romanticized version stems from old English writers who created adventure tales based on relatable events that had taken place in the seas in recent years. Educators can still provide fictional pirate books within their classrooms, but what books are best and what is important to recognize about them before introducing them to a student? In addition, educators can also provide nonfiction texts and websites for students to use within the classroom to benefit academic goals and deliver a new, defined version of what piracy

22. "Pirate's Unit Study," TheHomeschoolMom.

truly was.

BIBLIOGRAPHY

- Barrie, James Matthew. *Peter and Wendy*. New York: Simon & Schuster, 1911.
- Buckley, James. *Who Was Blackbeard?* New York: Penguin Young Readers Group, 2015.
- Cohen, Monica Feinberg. "Imitation Fiction: Pirate Citings in Robert Louis Stevenson's *Treasure Island*." *Victorian Literature and Culture* 41, no. 1 (2013): 155–156. doi: 10.1017/S106015031200089.
- Dryden, Robert Gordon. "Successful Pirates and Capitalist Fantasies: Charting Fictional Representations of Eighteenth- And Early Nineteenth-Century English Fortune Hunters." Doctoral Dissertation, Louisiana State University, 2000.
- Eager, Lindsay. *Race to the Bottom of the Sea*. Massachusetts: Candlewick Press, 2017.
- Edington, Ian. *The Red Seas: Under the Banner of King Death*. Oxford: Rebellion Publishing, 2005.
- Grasso, Joshua. "The Providence of Pirates: Defoe and the 'True-Bred Merchant.'" *Digital Defoe: Studies in Defoe & His Contemporaries* 2, no. 1 (2010): 30. <https://english.illinoisstate.edu/digitaldefoe/archive/spring10/features/grasso.html>.
- Johnson, Charles. *A General History of the Robberies and Murders of the Most Notorious Pirates*. Britain: Charles Rivington, 1724.
- Johri, Shatakshi, and S. Krishnan. "Piracy And Maritime Security: Regional Characteristics and Political, Legal and Economic Implications." *World Affairs: The Journal of International Issues* 23, no. 3 (2019): 81. JSTOR, <https://www.jstor.org/stable/48531052>.
- Lindberg, Mary Anne. "Survival Literature in Children's Fiction." *Elementary English* 51, no.3 (1974): 330. JSTOR, <https://www.jstor.org/stable/41387166>.

Matthews, John. *Pirates*. New York: Atheneum Books for Young Readers, 2006.

Matthews, John. *Pirates Most Wanted*. New York: Atheneum Books for Young Readers, 2006.

Medina, Nico. *Who Was Leif Erikson?* London: Penguin Young Readers Group, 2018.

Osborne, Mary Pope, and Sal Murdocca. *Pirates Past Noon*. New York: The Random House, 1994.

Osborne, Will, and Mary Pope Osborne. *Magic Tree House Fact Tracker: Pirates*. New York: Random House Books for Young Readers, 2012.

“Pirate’s Unit Study.” TheHomeschoolMom. Accessed December 5, 2021. <https://www.thehomeschoolmom.com/homeschool-lesson-plans/pirates-unit-study/>.

Queen Anne’s Revenge Project. Accessed December 5, 2021. <https://www.qa-online.org/>.

Rediker, Marcus. “‘Under the Banner of King Death’: The Social World of Anglo-American Pirates, 1716 to 1726.” *The William and Mary Quarterly* 38, no. 2 (1981): 220. doi: 10.2307/1918775.

Steer, Dugald. *Pirateology: The Pirate Hunters’ Companion*. Massachusetts: Candlewick Press, 2006.

Stevenson, Robert Louis. *Treasure Island*. New York: Macmillan Company, 1902.

“What are Lexile Student Measures by Grade?” Lexile & Quantile Tools. Accessed December 6, 2021. <https://hub.lexile.com/lexile-grade-level-charts>.

“Ye Parks of Privates and Privateers.” National Park Service. Accessed December 5, 2021. <https://www.nps.gov/subjects/pirates/parks.htm>.

African Textile Traditions in America:

Slavery's Impact on Art

Hanna Henroid

Abstract

In this paper, I explore the history of African American textiles in America. I begin with a discussion of the Transatlantic slave trade. Then, the paper is broken up into sections: African textiles, textiles of enslaved people, textiles after emancipation, and contemporary textiles. I provide examples from each category for consideration, oral or written accounts by the creator when possible, and historical background. I argue that works from these time periods are impacted by African tradition passed down through the descendants of enslaved people. The evolution of textiles is acknowledged, as well as the growth of a new tradition as African Americans develop the practice in the States.

The Transatlantic slave trade forcefully lifted people from their homes and attempted to strip them of all identity. Nonetheless, Africans traded across the Atlantic brought something of their own with them: culture. Rather than submitting to the horrors of enslavement, the Africans found solace in the continuation of their heritage. In Africa, textiles held high esteem in many cultures, and their creation was often an important community effort. In America, enslaved people applied these African textile techniques and aesthetics to various fiber arts. Through an exploration of the history of textiles among Africans and their descendants in America, common themes appear. Traditional African art practice informed the textile arts of enslaved Africans, freed African Americans, and contemporary Black artists. Despite the slave trade's attempted suppression of culture, Africans brought their heritage with them to America, and their impacts on textile art are still felt today.

In the sixteenth century, Europeans ventured into Africa and began laying the foundations for what would become the Transatlantic slave trade. Africans were plucked from their villages, kingdoms, and homes. For centuries, Europeans shipped millions of people across the ocean like merchandise and sold them into unfamiliar territory oozing with death, hardship, and cruelty. Africans were spread throughout the Atlantic and encountered horrific situations during their enslavement. While most people ended up in South America or the Caribbean,¹ The United States became the new grounds for some Africans. Through the seventeenth and eighteenth centuries, enslaved people faced unforgiving lives in America and were forced to adapt. They practiced small acts of resistance wherever possible,² including acts of creation. Through teaching, remembering, and creating textiles, enslaved people honored their heritage. Ideas and concepts changed along with the people, of course, yet the roots of their art remained in Africa.

Throughout Africa, textile techniques and aesthetics developed. Various cultures developed distinct styles, patterns, and methods. Traditionally, African textile arts were created from natural materials. The fibers were often stripped from inner bark layers or vegetation,³ and dyes were often coaxed out of flowers and earth.⁴ Fibers could also come from cotton, silks,⁵ and other natural processes. Africans often assembled the fibers together through various weaving

1. Steven Mintz, "Historical Context: Facts about the Slave Trade and Slavery," Teaching Literacy Through History, Gilder Lehrman Institute of American History, <https://www.gilderlehrman.org/history-resources/teacher-resources/historical-context-facts-about-slave-trade-and-slavery>.

2. "Immigration and Relocation in U.S. History: Resistance and Abolition," Library of Congress, <https://www.loc.gov/classroom-materials/immigration/african/resistance-and-abolition/>.

3. Roy Sieber, *African Textiles and Decorative Arts*. The Museum of Modern Art, New York. (New Haven: Eastern Press Inc., 1972), 127:155.

4. Roy Sieber, 181:196.

5. Unknown Artist, *Textile (kente)*, silk and dye. C. 1925, Dallas Museum of Art. <https://www.dma.org/art/collection/object/5327272>.

techniques.⁶ The designs could be stamped, printed, or embroidered on.⁷ Comparing two different African textiles like the Kente Cloth from the Asante peoples of Ghana (Figure 1) and the Wrapper Bogolanfini (mud cloth) created by the Bamana people of Mali (Figure 2), similarities and differences are evident in textiles in various regions of the continent. The differences are of material: Kente cloths were often made with woven silk and dye⁸ or rayon,⁹ and the Bogolanfini was made with mud-painted cotton.¹⁰ The similarities lie in the abstraction, organization, pattern, and intent. Abstraction often dominated African art. The images and patterns incorporated in textiles were not commonly naturalistic, instead opting for geometric or exaggerated details.

Furthermore, the designs incorporated in these textiles held a variety of meanings; different patterns referred to local mythology,¹¹ belief, politics, and status.¹² The Asante peoples' Kente cloth's iconic style is instantly recognizable with its bright colors, geom-

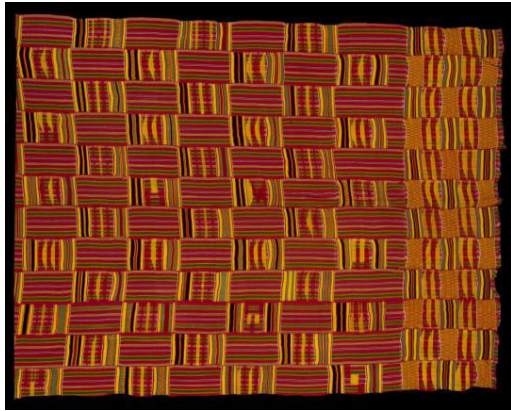


Figure 1: Unknown African Artist, *Kente Cloth*, 1940–1950, rayon, 44.25 x 76.5 in. The Museum of Fine Arts, Houston. Gift of Alfred C. Glassell, Jr. <https://emuseum.mfah.org/objects/33368/kente-cloth>.



Figure 2: Mali, Bamana peoples. *Wrapper (Bogolanfini)*, 19th–20th century. Cotton, dye. H. 37 x W. 57 11/16 in. (94 x 146.5 cm). The Metropolitan Museum of Art, The Michael C. Rockefeller Memorial Collection, Bequest of Nelson A. Rockefeller, 1979. <https://www.metmuseum.org/art/collection/search/312395>.

6. Christine Giuntini, interview by Susan Brown, "Patterns without End: The Techniques and Designs of Kongo Textiles," *The Metropolitan Museum of Art (blog)*, December 18, 2015, <https://www.metmuseum.org/exhibitions/listings/2015/kongo/blog/posts/patterns-without-end>.

7. Kathleen E. Musa, "African Textiles," *African Arts* 12, no. 2 (1979): 78, *JSTOR*.

8. *Textile (kente)* (description), Dallas Museum of Art.

9. Unknown Artist, *Unknown African Kente Cloth*, rayon. 1940–1950, Museum of Fine Art, Houston, <https://emuseum.mfah.org/objects/33368/kente-cloth>.

10. Unknown Artist, *Wrapper (Bogolanfini)*, cotton and dye. 19th–20th century, Metropolitan Museum of Art, <https://www.metmuseum.org/art/collection/search/312395>.

11. Victoria Rovine, "Bogolanfini in Bamako: The Biography of a Malian Textile," *African Arts* 30, no. 1 (1997): 41, *JSTOR*.

12. Sjarief Hale, "Kente Cloth of Ghana," *African Arts* 3, no. 3 (1970): 26, *JSTOR*.

etry, and boldness of design.¹³ Strips of different woven patterns, colors, and compositions represent specific ideas, environments, and proverbs.¹⁴ The strips are then connected in a patchwork-like fashion. Traditionally, Kente cloth was worn for “ceremonial occasions” and by royalty.¹⁵ In fact, if a pattern was named “Adweneasa,” meaning “my skill is exhausted,” then the finished Kente cloth could only be worn by the king.¹⁶ The design choice showed status and directly correlated to Asante belief and politics.

The Kente cloth in Figure 1 uses yellow, red, and green in an impression of horizontal lines. Upon closer inspection, the designs seem to be broken up into rough squares, and each square has an individual, intricate geometric pattern. This particular cloth is a variation of the Oyokoman Adweneasa pattern, named in tribute to the Oyoko Clan, and harkens back to the origin stories of two farmers watching a spider weave intricate webs.¹⁷ The oral history recounted Kente cloth’s inspiration from nature, another reflection of African peoples’ traditions of using natural resources.

The Bogolanfini cloth of the Bamana peoples boasts a striking beauty as well. The cloth is made through an intensive process of woven cotton strips sewn together, then covered with mud in negative space around the desired pattern. As the mud washes away, it leaves a dark background for the lighter cotton designs to contrast, all achieved through the use of natural, local materials.¹⁸ The geometric patterns represent a “visual language” passed down from older generations to young women and are abstractions¹⁹ of everyday objects that often tie to “significant events” in life such as coming-of-age, childbirth, and death.²⁰ The cloth gives the wearer a special status as they have achieved something.

The Bogolanfini cloth in Figure 2 consists of a dark brown background and white-yellow designs broken up into five sections. The central designs, in vertical columns, detail dots, circles, and arrows. An irregular border-like design of tightly packed circles and diamonds and irregular implied zigzags surround the vertical columns. The tightly packed dots in the horizontal strip at the top, called tigafaranin, refers to a beaded belt worn by young women that represents fertility.²¹ Therefore, this textile was probably intended for Bamana women coming-of-age and marked an important transitory moment in their

13. Hale, 26.

14. Shea Clark Smith, “Kente Cloth Motifs,” *African Arts* 9, no. 1 (1975): 38, *JSTOR*.

15. Hale, “Kente Cloth of Ghana,” 26:29.

16. Hale, 29.

17. Shea Clark Smith, “Kente Cloth Motifs,” 36.

18. Victoria Rovine, “Bogolanfini in Bamako,” 40–41.

19. *Wrapper (Bogolanfini)* (description), Metropolitan Museum of Art.

20. Victoria Rovine, “Bogolanfini in Bamako,” 41.

21. *Wrapper (Bogolanfini)* (description), Metropolitan Museum of Art.

lives.²² The ceremonial aspect of the cloth refers to the importance of status and changes in life.

For both the Kente and Bogolanfini, designs hold significance. In fact, across Africa, different textile patterns and motifs had many different functions: They could be used as a teaching method, to refer to status²³ or kinship,²⁴ or as a currency.²⁵ Overall, the life and meaning behind a textile differed across Africa, yet the practice of textiles was common.

When brought to America, textiles didn't lose their impact. Enslaved Africans continued the practices of textile trade, creation, and appreciation. The traditions of African textiles spread through generations of enslaved people. Of course, the workings of the traditions changed due to the circumstances of enslavement. Still, the Africans held on to what they could of their cultural past.

During the time of enslavement, enslaved people were given very little time or resources of their own. However, some enslaved women were taught to sew.²⁶ Their sewing projects were probably not for personal gain, instead taking the form of hemming clothing, creating clothes, or patching up other household textiles for their enslavers. Nonetheless, the women were taught a useful skill. Some women used the skill to reclaim some autonomy over their lives, such as enslaved woman Mary F. McCray. Her husband said she "loved to sow [sic] and knit and piece quilts," but could only work late at night due to being "obliged to work" during the day.²⁷ Others used the work to connect to their African roots. Enslaved woman Tempie Durham recalled the fabric-dyeing talents of "Mammy Rachel," another woman on the same plantation. Durham explained the different natural materials like bark and berries that her mother used for dyeing.²⁸ Durham's mother's treatment of cloth in the American South closely resembled the treatment of textiles throughout Africa. African experience likely informed the use of natural materials and the knowledge of botany. The practice itself adapted to the circumstances.

Even if enslaved people themselves did not make it, textiles still held importance. Just as it was customary in Africa, enslaved people in the United States often used clothing as currency.²⁹ The power of textiles did not fade as the Afri-

22. *Wrapper (Bogolanfini)* (description), Metropolitan Museum of Art.

23. Alisa LaGamma, "The Essential Art of African Textiles: Design without End," *African Arts* 42, no. 1 (2009): 89, *JSTOR*.

24. Norma H. Wolff. Review of "Yoruba Religious Textiles: Essays in Honor of Cornelius Adepegba," by Elisha P. Renne and Babatunde Agbaje Williams. *African Arts* 39, no. 4 (2006): 12. *JSTOR*.

25. Alisa LaGamma, "Design without End," 88.

26. Frederick Samuel Newell, *Newell's Notes on the Cruel and Licentious Treatment of the American Female Slaves* (London: William Tweedie, 1864), 6.

27. S.J. McCray, *Life of Mary F. McCray: Born and Raised a Slave in the State of Kentucky* (Ohio: 1898), 8.

28. Federal Writers' Project, *The American Slave: a Composite Autobiography*, ed. George P. Rawick (United States: Smithsonian Libraries, (1972) 15:285–286.

29. Shane White and Graham White, "Slave Clothing and African-American Culture in the Eighteenth and Nineteenth Centuries," *Past & Present*, no. 148 (1995): 160. *JSTOR*.

cans adjusted to their new surroundings—instead they worked with what they could get their hands on. Due to enslavement’s restrictions, owning and obtaining belongings was difficult.³⁰ Women in these circumstances regardless found it important to show love through the gift of textiles.³¹ Just as in Africa, where textiles served as a sign of respect and celebration, enslaved women shared their few belongings as parting gifts. The creation of textiles in the African tradition fell during the time of enslavement due to the harsh conditions inflicted upon enslaved people. Still, enslaved people used whatever method they could to persevere and keep their heritage intact.

Following emancipation, which occurred in 1865 in America, African Americans found themselves with more freedom. The formerly enslaved people now had more control over

their lives; however, racism still plagued America. As a result, it may have been difficult to find work and secure income. During this time, African Americans often made quilts out of necessity. The fabrics used were typically scraps and the completed quilts served as warmth³² or protection.³³ The treatment of the scraps and arrangements of colors and shapes may have been influenced by African heritage. As seen, enslaved people tried to carry forth their traditions any way possible and pass down their practices to their children. African Americans again embraced their lineage once freed. Some quilters across the United States highlighted the African connection in their works. Harriet Powers, the quilters of Gee’s Bend, and Elizabeth “Lizzie” Hobbs Keckley produced different styles of quilts, yet all these have elements similar to African tradition.

Harriet Powers, born into enslavement in Clark County, Georgia,³⁴ created story quilts. The quilts were made of cotton³⁵ and used a pieced applique style,



Figure 3: Harriet Powers, *Pictorial Quilt*, c. 1895-98, Cotton plain weave, pieced, appliqued, embroidered, and quilted, 68 7/8 x 105 in. Boston

30. Tiya Miles, “How the Survivors of Slavery Used Material Objects to Preserve Intergenerational Wisdom,” *Literary Hub* via The Cundill History Prize.

31. Miles, “Material Objects.”

32. Patricia Hunt-Hurst, “Georgia History in Pictures Collecting the Pieces: Images of Georgia Quilts,” *The Georgia Historical Quarterly* 88, no. 4 (2004): 530-531. *JSTOR*.

33. Society for Promoting the Cessation of Hostilities in America, *Federal “Emancipation”* (1864), 5.

34. Harriet Powers, *Pictorial Quilt* (description), cotton, 1895-98, Museum of Fine Arts Boston, <https://collections.mfa.org/objects/116166>.

35. Powers, *Pictorial Quilt* (description).

which consist of a large motif, a repeated pattern, or a narrative. In Powers's case, she quilted historical or religious narratives.³⁶ Her quilt Pictorial Quilt from 1895–1898 showcased fifteen squares representing different biblical stories (Figure 3). Powers herself gave an oral narration of what stories the squares told: The quilt depicted stories from both the Old and New Testament, including Adam and Eve in the Garden of Eden (row one, square four), Jonah and the Whale (row two, square one), and the Crucifixion of Christ (row three, square five).³⁷

Visually, Powers's Pictorial Quilt was divided into squares with individual, abstracted narratives. No figure-ground relationship existed. Instead, the flatly colored figures and shapes occupied the whole of the square without any sense of depth. The abstraction of the shapes may be a stylistic choice in remembrance of African design carried on by the people Powers would have known during her time as an enslaved woman. The gridded narrative of the applique figures resemble African textiles as well. Looking at the textile Adire from the Yoruba culture in modern day Nigeria, one can begin to see similarities.

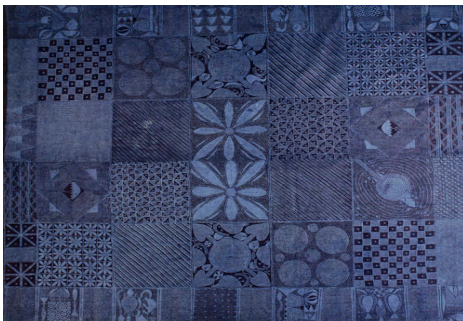


Figure 4: Unknown, Wrapper (*Adire*), c. 20th century, Cotton, 71 in. New York, Metropolitan Museum of Art.

The Yoruba Adire (Figure 4) is made of indigo-dyed cotton³⁸ and composed of a grid surrounded by a border with smaller squares inside. Inside each square is a geometric motif referring to Yoruba culture.³⁹ This pattern is known as Olokun⁴⁰ and consists of a variety of representational patterns⁴¹ of proverbs, religious motifs⁴²—such as a Qur'an board⁴³—and other depictions of Yoruba life. These Adire created a historical narrative of

Nigeria during the slave trade. The cloth is consistent with other African textiles in its abstraction of images, heavy pattern usage, natural materials, and the influence of life and stories.

Both textiles used a grid format to share larger ideas and concepts: Powers's

36. Patricia Hunt-Hurst, "Images of Georgian Quilts," 531-532.

37. Rita Fuller-Yates, "Harriet Powers (1837–1910)," Black Past, November 9, 2020, <https://www.blackpast.org/african-american-history/harriet-powers-1837-1910/>.

38. "Adire—'Tied and Dyed' Indigo Textiles," Victoria and Albert Museum, <https://www.vam.ac.uk/articles/adire-tied-and-dyed-indigo-textiles>.

39. "Adire," Victoria and Albert Museum.

40. Yoruba artist, *Wrapper (adire eleko)* (description), indigo-dyed cotton, mid-20th century. St. Louis Art Museum, <https://www.slam.org/collection/objects/54258/>.

41. *Adire* (description), cotton, C. 1971. The British Museum, https://www.britishmuseum.org/collection/object/E_Af1971-35-15.

42. Lisa Aronson, "The Language of West African Textiles," *African Arts* 25 no. 3 (1992): 40. JSTOR.

43. *Adire* (description), The British Museum.

Pictorial Quilt represented Christian beliefs, and the Adire represented Muslim beliefs, among other cultural elements.



Figure 5 : Mary Lee Bendolph, *Housetop variation*, 1998, Cotton corduroy, twill, assorted polyesters, 74 x 74 in. <https://www.soulsgrowndeep.org/artist/mary-lee-bendolph/work/housetop-variation>

Both directly related to enslavement and its effects on Africa and its peoples. They differ in their use of material: Pictorial Quilt used sewing and applique techniques, while the Adire used weaving and dyeing.⁴⁴ The differences in Powers's story quilts compared to African textiles may be because of her upbringing away from Africa, knowing Africa only through stories or through others, or because of available resources. Scholars do not know Powers's ancestry, and no record explains exactly what she learned from the people around her. Yet her work seems to grow from African roots.

Similarly, scholars can't say for sure if Afri-

can textiles influenced Gee's Bend quilts, yet the likeness cannot be ignored. Gee's Bend is a small African American community in rural Alabama, tucked away on the site of an old plantation.⁴⁵ Many of the people living there are descendants of those once enslaved on the plantation.⁴⁶ Many women of Gee's Bend have been practicing quilting "at least since the beginning of the twentieth century."⁴⁷ The quilt "Housetop" Variation made by Mary Lee Bendolph in 1998 shows multi-colored squares and rectangles combining in a dizzying movement (Figure 5). The abstract shapes seem to form a pattern, yet no predictable organization can be found. Similarly, the Kuba people of Zaire (Democratic Republic of Congo) in Africa created textiles with morphing



Figure 6: *Embroidered Raffia Pile Cloth*, 1900s. Africa, Central Africa, Democratic Republic of Congo, Kuba peoples, 20th century. Raffia and dye; overall: 57.5 x 50.8 cm (22 5/8 x 20 in.); mounted: 64.5 x 56.5 cm (25 3/8 x 22 1/4 in.). The Cleveland Museum of Art, Anonymous gift in honor of the Museum's seventy-fifth anniversary 1992.102 This image is in the public

44. *Adire* (description), The British Museum.

45. Isom Moseley, interview by Robert Sonkin, transcript and recording, Gee's Bend, Alabama, 1941.

46. Nancy Scheper-Hughes, "Anatomy of a Quilt: The Gee's Bend Freedom Quilting Bee," *Anthropology Today* 19, no. 4 (2003): 15. *JSTOR*.

47. Scheper-Hughes, 18.

designs.⁴⁸ The Embroidered Raffia Pile Cloth (Figure 6), made in the 1900s, builds off an older regional textile tradition. The tradition of Kuba cloths involves creating complex patterns through embroidery.⁴⁹ Just as the women of Gee's Bend sewed their patches together to create their pattern, the Kuba cloth's patterns were stitched onto the fabric. The rhythmic not-pattern evident in the textiles of both the Kuba people and the Gee's Bend residents are similar. The idea of designs flowing into each other seamlessly and the final products are far too similar for coincidence.



Figure 7: Elizabeth Hobbs Keckley, Untitled, c. 1862–1880, quilted silks. Kent State University Museum. <https://www.kent.edu/museum/exhibits#>.

On top of this, the quilts of Gee's Bend showed characteristic African abstraction and splendor. Yet, once again, scholars may not be able to determine the heritage of the women of Gee's Bend. Still, they were tightly knit with their fellow enslaved community pre-emancipation. The idea of cultural continuity remains evident in the similarities of execution in the textiles.

Elizabeth Hobbs Keckley, another quiltmaker post-emancipation, was born into enslavement.⁵⁰ Her enslaver in St. Louis hired her out as a seamstress, where she raised the funds to buy her freedom.⁵¹ Due to Keckley's experiences as a seamstress, she learned strong sewing skills.⁵² Eventually, she gained employment at the White House⁵³ and became close with Mary Todd Lincoln, President Abraham Lincoln's wife.⁵⁴ While Keckley mainly worked on dresses,⁵⁵ she also produced several quilts.

An untitled quilt attributed to Keckley (Figure 7) supposedly contains

48. Monni Adams, "Kuba Embroidered Cloth," *African Arts* 12, no. 1 (1978): 24:26, JSTOR.

49. Adams, 26.

50. Elizabeth Hobbs Keckley, *Behind the Scenes, or, Thirty Years a Slave, and Four Years in the White House* (New York: G. W. Carleton & Co., 1868), 17. Documenting the American South, University of South Carolina at Chapel Hill.

51. Keckley, 59–60.

52. Keckley, 45.

53. Keckley, 76.

54. Keckley, 89–91.

55. Keckley, 90.

scraps from dresses belonging to Mrs. Lincoln⁵⁶ and other politicians' wives with whom Keckley worked.⁵⁷ The quilt consists of a repetition of squares radiating out from a center square that contains a dove, the United States flag, and the word "liberty." The overall colors are red, white, and blue. Subsequent squares consist of floral designs, mosaic-esque pieced flowers, and geometric shapes. Red tassels border the entire quilt.

Through the Lincoln dress quilt, Keckley contributed to the growing tradition of African American quilting. Additionally, she provided an extraordinary example considering the direct ties the quilt had to the presidential family responsible for emancipation and strong visual response to the end of enslavement. The piece provided priceless insight into cultural values and changes of the time period. Therefore, also considering the scrap-piecing technique and pattern usage, the quilt is distinctly African American in style.

Contemporary art can build off the African American developments of African art, or it can build off the study and reclamation of traditional African art. Due to easier access to travel, communication, and trade, cultures have spread widely. As a result, the people whose ancestors were forcefully removed from their homes found opportunities to connect with their heritage. Still, African Americans provided a critical contribution to contemporary American culture. Through the experience of enslavement, emancipation, and civil rights movements, Black Americans developed a wholly new cultural ideal. Today, artists acknowledge the hybrid culture enslavement created in America while also reconciling with their African heritage.

For starters, American artist Faith Ringgold creates story quilts not unlike Harriet Powers's work. Her work revolves around what Ringgold herself describes as "Black history [and] African culture."⁵⁸ Ringgold grew into her artistic talent first during the civil rights movement, and her activism influenced the rest of her artistic career.⁵⁹ Ringgold's story quilts depict images (typically involving African American culture or her own personal life) painted directly onto a quilted blanket.⁶⁰ The medium recalls both African American tradition and domestic work. The African American tradition of storytelling traces back through oral history up into visual narratives. Stories transmitted legends, families, and culture throughout African American communities. Ringgold tapped into this critical aspect of community and explored it through her story quilts. She studied the origin of quilts and African cultural designs to make informed

56. Textile Research Centre Leiden, "Sewing for Freedom: Elizabeth Keckley," <https://www.trc-leiden.nl/trc/index.php/en/inspiration/intensive-textile-course/102-news/1057-sewing-for-freedom-elizabeth-keckley>.

57. Kent State University, "Explore Ohio's Rich History in the Kent State University Museum's 'Ohio Quilts' Exhibition," December 9, 2022, <https://www.kent.edu/kent/news/kent-state-university-museum-ohio-quilts-exhibition>.

58. Faith Ringgold and Josephine Withers, "Faith Ringgold: Art," *Feminist Studies* 6, no. 1 (1980): 207. *JSTOR*.

59. Makers, "Faith Ringgold: Artist & Activist," YouTube, May 16, 2012, 3:30, <https://youtu.be/Comf9SetjRA>.

60. Makers, "Faith Ringgold."

decisions about her artwork.⁶¹ She found that African history was rich with textiles, that enslaved people developed skills in sewing and quilting, and that African influence permeated all throughout enslaved peoples' artistic decisions and abilities.

In the piece *Woman on a Bridge #1 of 5: Tar Beach* (Figure 8), Ringgold painted the roof of the building in which she lived in her youth in Harlem, also called tar beach, and figures fashioned after people she knew as a child.⁶²

A written story borders the painted design, reminiscent of the tales spread among African American communities. The figures are less abstracted than previous works of African tradition, yet they still have an exaggeration to them. The figures and shapes aren't naturalistic, rather they capture the soul of the person. The border of patterned squares surrounding the painted image call to mind scrap pieced quilts as well.



Figure 8: Faith Ringgold, *Woman on a Bridge #1 of 5: Tar Beach*, 1988, Acrylic paint, 74 5/8 x 68 1/2 in. Solomon R. Guggenheim Foundation, <https://www.guggenheim.org/artwork/3719>.

Through her research, Ringgold ensured her work made connections to African and African American heritage.

In an interview, Ringgold said her great grandmother and great-great grandmother were both quiltmakers—and both born slaves—and therefore she felt quilting was in her blood, in her ancestry.⁶³ Of course, at the time, quilting was a product of necessity. However, Ringgold embraced this necessity and transformed it into high art. She revitalized African and African American textile techniques to share her experiences, to celebrate the African American

61. Craft in America, "Quilt Artist Faith Ringgold, THREADS episode," YouTube, October 30, 2014, video, 14:11, <https://youtu.be/cU9MpcHfwiA>.

62. Craft in America, "Quilt Artist Faith Ringgold."

63. Osei Bonsu, "50 Years of Celebrating Black Beauty and Culture: Faith Ringgold." Frieze, April 19, 2018, <https://www.frieze.com/article/50-years-celebrating-black-beauty-and-culture-faith-ringgold>.

community, and to educate about civil rights.⁶⁴ The reach of African tradition spread from the 1500s to the 1900s, and was utilized as a tool to gain recognition as a Black woman, just as enslaved people used African tradition to maintain identity.



Figure 9. Bisa Butler, *The Safety Patrol*, 2018, Cotton, wool, and chiffon, appliquéd and quilted. Art Institute of Chicago, <https://www.artic.edu/artworks/249299/the-safety-patrol>.

Another textile artist, Bisa Butler, creates cloth portraits that celebrate Black life. Born in New Jersey to American and Ghanaian parents, she received an education in art from Howard University.⁶⁵ Her upbringing surrounded by art and African American artists deeply influenced her own practice. Butler's work exclusively depicts African Americans among bright colors and patterns. Originally, she depicted family members and friends, but eventually, vintage photographs of people who reminded her of family and friends inspired her work.⁶⁶ Through her

combined use of personal connections and history, Butler's work ties in intricately with the African American experience and communities across time.

Butler's piece *The Safety Patrol* (Figure 9) is applique and quilted fabric that, at first glance, looks like a painting. It depicts seven children against a gray floral patterned background. The boy in the center stands in front of the other kids, and his outstretched arms protect them. He stares directly out at the viewer, possibly made to evoke Frederick Douglass, the famous African American abolitionist who deliberately stared at his photographers in defiance of the stereotype of Black people as "inferior, ignorant, and timid,"⁶⁷ as Butler describes in an interview. Indeed, the boy's stare, along with his powerful stance and sash adorning his chest, radiates authority. In fact, all of the children stare directly at the viewer, assuming the same confidence. All of the subjects also wear heavily patterned clothing reminiscent of African textiles. The overall effect is one of fearlessness and pride.

64. Craft in America, "Quilt Artist Faith Ringgold."

65. Sok Vision, "Bisa Butler: Quilting for Culture," Art Institute of Chicago, YouTube, October 15, 2020, 5:51, <https://www.youtube.com/watch?v=dCkNMK2QtUY>.

66. Sok Vision, "Bisa Butler on Representing Culture," Art Institute of Chicago, YouTube, August 7, 2020, 2:21, <https://www.youtube.com/watch?v=b4eCn6x3Q6w>.

67. Bisa Butler and Emily Freidenrich, "Q&A with Bisa Butler," American Craft Council, August 12, 2021, <https://www.craftcouncil.org/post/qa-bisa-butler>.

The quilted and applique techniques used in the piece recall the importance of quilts in African American history. Like Ringgold, Butler also taps into the ideas of community. She explores the continuation of community by depicting children, although individualized, standing together and facing the world head-on. She gives power to Black youths and represents them as future leaders. Further, their clothing directly ties them to an African heritage, as Butler used “Kool-Aid” colors like bright oranges, yellows, crimson reds, and blues, which she described as rooted in Africa but distinctly acknowledged as a new African American technique.⁶⁸ Through this color palette, she acknowledges the impact African art had on contemporary African American artists. All seven of the children wearing a variation of the Kool-Aid palette and African-esque patterns creates a visual community and references the larger African American community in the United States.

Another artist, Clara Nartey, immigrated to America from Africa.⁶⁹ Her textile portraits use bright, bold colors and patterns reminiscent of African textiles, with her process explanations specifically citing “kente, mud cloth, and adinkra.”⁷⁰ The same Kool-Aid colors found in Butler’s work are evident in Nartey’s art. Furthermore, Nartey’s “ancestors who were brought to America several generations ago” informed her recent series *Black Crowns*.⁷¹ Her work engages with the entanglement of African American and African history.

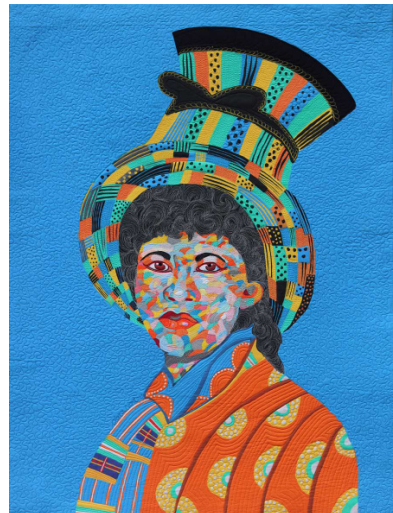


Figure 10: Clara Nartey, *Catching God's Eye*, 2020, inks and threads on cotton, 40"×30", courtesy of the artist.

The piece *Catching God's Eye*, part of the *Black Crowns* series,⁷² was made of threads and printed inks on cotton (Figure 10).

The textile shows a figure, a woman churchgoer,⁷³ against a bright blue background. The figure wears brightly colored and complexly patterned clothing with a large, similarly bright and intricately patterned hat. The figure stares directly out at the viewer. Her look is as bold and prideful as the clothing she wears. Subtle embroidered and quilted designs cover the piece with even more

68. Sok Vision, “Quilting for Culture.”

69. Clara Nartey, “Black Crowns,” *Clara Nartey* (blog), <https://claranartey.com/black-crowns/>.

70. Clara Nartey, “Processes and Materials,” Clara Nartey, <https://claranartey.com/wp-content/uploads/2020/12/Processes-and-Materials.pdf>.

71. Clara Nartey, “Black Crowns.”

72. Clara Nartey, “Catching God's Eye—The Story Behind the Art,” Clara Nartey (blog), October 16, 2020, <https://claranartey.com/catching-gods-eye-the-story-behind-the-art/>.

73. Nartey, “Catching God's Eye.”

pattern.

According to Nartley, the hats of church ladies inspired this textile art piece. She says: “Enslaved Africans were not allowed to dress the way they wanted. The only times they got to express themselves in clothes was when they got the rare occasion to congregate at church.”⁷⁴ The textile celebrates the combination of African American autonomy and small acts of resistance as well as African heritage. The historical narrative that inspired the work⁷⁵ created a unique perspective on African American experiences from an African artist. As illustrated by Nartley’s textile artwork, African textiles brought into America and carried through the present African diaspora evolved into a new, distinct artform reminiscent of both African heritage and Black experiences in America.

The Transatlantic slave trade brought countless travesties and unforgivable cruelties upon the enslaved Africans. However, enslaved people did not allow the devastation to break them. Instead, cultural continuation in the form of textiles flourished as best as possible under the circumstances. Histories and practices spread among the enslaved people, then through the freed Black people, and into today where the heritage is used to continue the fight against the effects of enslavement. The evolution of artistic style and culture continued with enslaved people and their descendants until a new, unique approach developed. Africans brought their culture to America with them and established a new tradition of creation and storytelling as resistance. Although African influence is prevalent, contemporary African Americans created a distinct textile presence in America. Despite all efforts to the contrary, art and culture protected its practitioners. In return, the practitioners use art and culture to protect their heritage.

74. Nartey, “Catching God’s Eye.”

75. Nartey, “Catching God’s Eye.”

BIBLIOGRAPHY

- Adams, Monni. "Kuba Embroidered Cloth." *African Arts* 12, no. 1 (1978): 24–39+106–07. JSTOR, doi:10.2307/3335378.
- "*Adire*," (description) Cotton, C. 1971. The British Museum, London. https://www.britishmuseum.org/collection/object/E_Af1971-35-15.
- Aronson, Lisa. "The Language of West African Textiles," *African Arts* 25 no. 3 (1992): 36–40+100. JSTOR. doi: 10.2307/3336998.
- Bonsu, Osei. "50 Years of Celebrating Black Beauty and Culture: Faith Ringgold." Frieze, April 19, 2018, <https://www.frieze.com/article/50-years-celebrating-black-beauty-and-culture-faith-ringgold>.
- Butler, Bisa, and Emily Freidenrich. "Q&A with Bisa Butler." American Craft Council, August 12, 2021. <https://www.craftcouncil.org/post/qa-bisa-butler>.
- Craft in America. "Quilt Artist Faith Ringgold, THREADS episode." YouTube, October 30, 2014, 14:11. <https://youtu.be/cU9MpcHfwiA>.
- Dallas Museum of Art, *Textile (kente)* (description), silk and dye. C. 1925. <https://www.dma.org/art/collection/object/5327272>.
- "Explore Ohio's Rich History in the Kent State University Museum's 'Ohio Quilts' Exhibition." Kent State University. December 9, 2002, <https://www.kent.edu/kent/news/kent-state-university-museum-ohio-quilts-exhibition>.
- Federal Writers' Project. Vol. 15 of *The American Slave; A Composite Autobiography*, Ed. George P. Rawick. United States: Smithsonian Libraries, 1972.
- Fuller-Yates, Rita. "Harriet Powers (1837–1910)." Black Past, November 9, 2020. <https://www.blackpast.org/african-american-history/harriet-powers-1837-1910/>.

Giuntini, Christine. Interview by Susan Brown. "Patterns without End: The Techniques and Designs of Kongo Textiles," *The Metropolitan Museum of Art* (blog), December 18, 2015, <https://www.metmuseum.org/exhibitions/listings/2015/kongo/blog/posts/patterns-without-end>

Hale, Sjarief. "Kente Cloth of Ghana." *African Arts* 3, no. 3 (1970): 26-29. JSTOR, doi:10.2307/3334492.

Hunt-Hurst, Patricia. "Georgia History in Pictures Collecting the Pieces: Images of Georgia Quilts." *The Georgia Historical Quarterly* 88, no. 4 (2004): 530–44. JSTOR, <http://www.jstor.org/stable/40584772>.

Keckley, Elizabeth Hobbs. *Behind the Scenes, or, Thirty Years a Slave, and Four Years in the White House*. New York: G. W. Carleton & Co., 1868. Documenting the American South, University of North Carolina at Chapel Hill, <https://docsouth.unc.edu/neh/keckley/keckley.html>.

LaGamma, Alisa. "The Essential Art of African Textiles: Design without End." *African Arts* 42, no. 1 (2009): 88–99. JSTOR, <https://www.jstor.org/stable/20447939>.

Library of Congress. "Immigration and Relocation in U.S. History: Resistance and Abolition." <https://www.loc.gov/classroom-materials/immigration/african/resistance-and-abolition/>.

Makers. "Faith Ringgold: Artist & Activist." YouTube, May 16, 2012, 3:30, <https://youtu.be/Comf9SetjRA>.

Mali, Bamana peoples. *Wrapper (Bogolanfini)*, 19th–20th century. Cotton, dye. H. 37 x W. 57 11/16 in. (94 x 146.5 cm). The Metropolitan Museum of Art, The Michael C. Rockefeller Memorial Collection, Bequest of Nelson A. Rockefeller, 1979. <https://www.metmuseum.org/art/collection/search/312395>.

McCray, S.J. *Life of Mary F. McCray. Born and Raised a Slave in the State of Kentucky*. Ohio: 1898. Documenting the American South, University of North Carolina at Chapel Hill, <https://docsouth.unc.edu/neh/mccray/>

mary.html.

Miles, Tiya. "How the Survivors of Slavery Used Material Objects to Preserve Intergenerational Wisdom," Literary Hub via The Cundill History Prize. <https://lithub.com/how-the-survivors-of-slavery-used-material-objects-to-preserve-intergenerational-wisdom/>.

Mintz, Steven. "Historical Context: Facts about the Slave Trade and Slavery," Teaching Literacy Through History. Gilder Lehrman Institute of American History. <https://www.gilderlehrman.org/history-resources/teacher-resources./historical-context-facts-about-slave-trade-and-slavery>.

Moseley, Isom. Interview by Robert Sonkin. Transcript and recording. Gee's Bend, Alabama, 1941. Library of Congress, https://www.loc.gov/item/afc1941018_afs05091a/.

Musa, Kathleen E. "African Textiles." *African Arts* 12, no. 2 (1979): 78–79. JSTOR, doi:10.2307/3335494.

Nartey, Clara. "Black Crowns." *Clara Nartey* (blog), <https://claranartey.com/black-crowns/>.

----- "Catching God's Eye- The Story Behind the Art." *Clara Nartey* (blog), October 16, 2020. <https://claranartey.com/catching-gods-eye-the-story-behind-the-art/>.

----- "Processes and Materials." Clara Nartey, <https://claranartey.com/wp-content/uploads/2020/12/Processes-and-Materials.pdf>.

Newell, Frederick Samuel. *Newell's Notes on the Cruel and Licentious Treatment of the American Female Slaves*. London: William Tweedie, 1864. https://books.google.com/books?id=yHwIAAAAQAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false.

"Pictorial Quilt" (description). Cotton, 1895–98. Museum of Fine Arts Boston, <https://collections.mfa.org/objects/116166>.

Ringgold, Faith, and Josephine Withers. "Faith Ringgold: Art." *Feminist Studies* 6, no. 1 (1980): 207–11. JSTOR, doi:10.2307/3177658.

Rovine, Victoria. "Bogolanfini in Bamako: The Biography of a Malian Textile." *African Arts* 30, no. 1 (1997): 40–51+94–96. JSTOR, doi:10.2307/3337471.

Scheper-Hughes, Nancy. "Anatomy of a Quilt: The Gee's Bend Freedom Quilting Bee." *Anthropology Today* 19, no. 4 (2003): 15–21. JSTOR, <https://www.jstor.org/stable/3695166>.

Sieber, Roy. *African Textiles and Decorative Arts*. New Haven: Eastern Press Inc., 1972. The Museum of Modern Art, New York, https://www.moma.org/documents/moma_catalogue_2553_300298962.pdf.

Smith, Shea Clark. "Kente Cloth Motifs." *African Arts* 9, no. 1 (1975): 36–39. JSTOR, doi.org/10.2307/3334979.

Society for Promoting the Cessation of Hostilities in America. *Federal "Emancipation."* 1864. doi:10.2307/60100169.

Sok Vision. "Bisa Butler on Representing Culture." Art Institute of Chicago, YouTube. August 7, 2020, 2:21, <https://www.youtube.com/watch?v=b4eCn6x3Q6w>.

Sok Vision. "Bisa Butler: Quilting for Culture." Art Institute of Chicago, YouTube.

October 15, 2020, 5:51, <https://www.youtube.com/watch?v=dCkN-MK2QtUY&t=268s>.

Textile Research Centre Lieden. "Sewing for Freedom: Elizabeth Keckley," <https://www.trc-leiden.nl/trc/index.php/en/inspiration/intensive-textile-course/102-news/1057-sewing-for-freedom-elizabeth-keckley>.

"*Unknown African Kente Cloth*," (description), Rayon. 1940–1950, Museum of Fine Art, Houston, <https://emuseum.mfah.org/objects/33368/kente>

cloth.

Victoria and Albert Museum. “Adire—‘Tied and Dyed’ Indigo Textiles.” <https://www.vam.ac.uk/articles/adire-tied-and-dyed-indigo-textiles>.

White, Shane, and Graham White. “Slave Clothing and African-American Culture in the Eighteenth and Nineteenth Centuries.” *Past & Present*, no. 148 (1995): 149–86. JSTOR, <http://www.jstor.org/stable/651051>.

Wolff, Norma H. Review of “Yoruba Religious Textiles: Essays in Honor of Cornelius Adepegba,” by Elisha P. Renne and Babatunde Agbaje Williams. *African Arts* 39, no. 4 (2006): 12+92–93 JSTOR, <https://www.jstor.org/stable/20447789>.

“*Wrapper (adire eleko)*” (description). Indigo-dyed cotton, mid-20th century. St. Louis Art Museum, <https://www.slam.org/collection/objects/54258/>.

FIGURE CREDITS

Figure 1: *Kente Cloth*, 1940–1950, rayon, 44.25 x 76.5 in. The Museum of Fine Arts, Houston. Gift of Alfred C. Glassell, Jr. This image is in the public domain. <https://emuseum.mfah.org/objects/33368/kente-cloth>.

Figure 2: Mali, Bamana peoples. *Wrapper (Bogolanfini)*, 19th–20th century. Cotton, dye. H. 37 x W. 57 11/16 in. (94 x 146.5 cm). The Metropolitan Museum of Art, The Michael C. Rockefeller Memorial Collection, Bequest of Nelson A. Rockefeller, 1979. <https://www.metmuseum.org/art/collection/search/312395>.

Figure 3: Harriet Powers, *Pictorial Quilt*, c. 1895–98, Cotton plain weave, pieced, appliqued, embroidered, and quilted, 68 7/8 x 105 in. Boston Museum of Fine Arts. <https://collections.mfa.org/objects/116166>.

Figure 4: Unknown, *Wrapper (Adire)* c. 20th century, Cotton, 71 in. New York, Metropolitan Museum of Art. This image is in the public domain. <https://www.metmuseum.org/art/collection/search/318002>.

Figure 5: Mary Lee Bendolph, *Housetop Variation*, 1998, Cotton corduroy, twill, assorted polyesters, 74 x 74 in. Phillips Collection...

Figure 6: Unknown, *Embroidered Raffia Pile Cloth*, c. 20th century, Raffia and dye, 22 5/8 x 20 in. Cleveland Museum of Art. This image is in the public domain. <https://www.clevelandart.org/art/1992.102>.

Figure 7: Elizabeth Hobbs Keckley, *Untitled*, c. 1862–1880, quilted silks. Kent State University Museum. This image is in the public domain . <https://www.kent.edu/kent/news/kent-state-university-museum-ohio-quilts-exhibition>.

Figure 8: Faith Ringgold, *Woman on a Bridge #1 of 5: Tar Beach*, 1988, Acrylic paint, canvas, printed fabric, ink, and thread. The Solomon R. Guggenheim Foundation. This image is in the public domain. <https://www.guggenheim.org/artwork/artist/faith-ringgold>.

Figure 9: Bisa Butler, *The Safety Patrol*, 2018, Cotton, wool, and chiffon, appliquéd and quilted. Art Institute of Chicago. This image is in the public domain. <https://www.artic.edu/exhibitions/9324/bisa-butler-portraits>.

Figure 10: Clara Nartey, *Catching God's Eye*, 2020, inks and threads on cotton, 40"×30", courtesy of the artist.

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Free-Standing Liquid Membranes as a Non-Fouling Filter for the Removal of Microplastics from Water

Daniel Amuedo

Abstract

Purification and refinement of crude substances from medical waste, industrial byproducts, and urban effluent is vital to ensure sustainability and avoid pollution. Current methods utilize chemical, physical, or mechanical filters which are expensive, unsustainable, and require consistent cleaning. This study explores a new filtration method; Free-Standing Liquid Membranes (FSLMs) to filter microplastics from water. FSLMs have several unique qualities: self-healing, non-fouling, sustainable, and inexpensive. This study follows a preliminary study that used sodium dodecyl sulfate (SDS) as a surfactant and glycerol as a hygroscopic agent. Both were optimized in a redesigned system to achieve the highest membrane longevity, stability, and reliability. Surface tension was quantified using a tensiometer to test if FSLMs are tunable for varying filtering qualities. The redesigned system is exceedingly stable in comparison to the older version and filtered amorphous flat PET particles with the highest success rate when using the 8.57 mM membrane solution. Future studies will explore other surfactants, hygroscopic agents, ring varieties, and its integration into current filtration technology.

Keywords: Free standing liquid membrane, microplastic, filtration

Background

According to the National Oceanic and Atmospheric Administration (NOAA), microplastics (MP) are non-biodegradable synthetic polymers that are less than 5 mm. Nanoplastics (NP) are any non-biodegradable synthetic polymers between 1 nm and 100 nm (Revel et al., 2018; Galloway, 2015). Microplastics are not a recent problem. As stated by the United Nations Environment Program, microplastic beads were first utilized in personal beauty products (NOAA, 2016), facial scrubs (Fendall & Sewell, 2009), soaps (Napper, 2015), cleansers (Gregory, 1996), and toothpastes (Sharma & Chatterjee, 2017) starting approximately 50 years ago (NOAA, 2016). However, not all manufactured plastic is microscopic: Due to the versatility and utility of plastics, the global plastic production rose to 348 million tons in 2017 from 335 million tons in 2016 (Plastics Europe, 2018). MPs and NPs can be further classified according to their origin as well. Primary microplastics are purposely made to be microscopic and are used in personal hygiene products, manufacturing, and many industrial processes. Secondary microplastics are formed from the breakdown of larger plastic objects due to the physical abrasions experienced by wind, water, or UV radiation (Rogers, 2022; Gewert et al., 2015; Andrady, 2011). Current research suggests that 69–81% of all the MPs in the ocean are estimated to have originated from secondary MPs, while 15–31% are estimated to come from primary MPs (Parliament, 2018).

Due to the durability of plastic, it has become one of the most ubiquitous man-made products and is becoming a known stratigraphic indicator of the Anthropocene (Zalasiewicz et al., 2016). It has been estimated that up to the year 2017, 8.3 billion metric tons of plastic have been produced, with current projections showing 12 billion metric tons being found in both landfills and the environment by 2050 (Geyer et al., 2017). This is further highlighted by the fact that even in Europe where 50% of produced plastic is accounted for, only 15–25% is actually recycled, with the rest heading for the landfill, and the other unaccounted 50% likely heading directly into the environment (Zalasiewicz et al., 2016) (Rochman et al., 2013). The United States, on the other hand, indicates that its overall recycling percentage is even lower at around 5% (Zalasiewicz et al., 2016). Most of the global plastics produced remain in the environment. Some plastics enter the oceans via marine activities, but 80% of plastic pollutants are estimated to have risen from land-based operations such as industrial runoff, tourism, litter, trash migration, ill-equipped wastewater treatment plants (WWTP), lakes, rivers, and agriculture (Jambeck et al., 2015; Alimi et al., 2018). MPs and NPs are found in circulating ocean currents, at

the polar regions, at the equator, in cities, on islands, and at beaches across the world (Peeken, 2018; Oberbeckmann, 2020). Similarly, MPs are present throughout the entire water column depending on the polymer's density (Oberbeckmann, 2020).

Due to their nearly ubiquitous presence, MPs have been found in more than 114 aquatic species (Rogers, 2022), with this list by no means exhaustive. This brings up the issue of its presence in seafood, which has been studied and observed in fish, shellfish, lobsters, and several other marine animals (Barboza et al., 2018). It is also present in other common foods such as: beer (Liebezeit, 2014; Kosuth, 2018), honey (Liebezeit, 2013), sugar (Liebezeit, 2013), salt (Yang et al., 2015; Kosuth, 2018; Karami, 2017; Íñiguez et al., 2017; Gündoğdu, 2018), canned sardines and sprats (Barboza et al., 2018), mineral drinking water (Schymanski et al., 2018), and tap water (Kosuth, 2018). Not only are MPs ubiquitous in the environment, but current literature also suggests that it is present in all humans to some degree. A study from 2018 obtained fecal samples from eight total participants in separate countries and found MPs in every single fecal matter sample (Schwabl et al., 2019). Humans are exposed to MPs through a plethora of exposure pathways some of which are being discovered currently.

The major pathways currently known are seafood, non-seafood, personal care products, drinking water, certain biomedical products, and inhalation. Since these pathways occur continuously, like breathing, these are all considered to be continuous sources of MP exposure (Storck et al., 2015; Bruck & Ford, 2018; Sussarellu, 2016; Schymanski et al., 2018). For example, a study (Hernandez, 2019) found that premium nylon tea bags released 11.6 billion MP particles and 3.1 billion NP particles when brewing tea at 95°C. This is worrying as studies indicate a dose dependent toxicity relationship with MPs (Hernandez, 2019) (Yong et al., 2020). Similarly, a study found MP fragments in both reusable and single-use plastic bottles (Schymanski et al., 2018). A more recent study conducted by the Trinity College Dublin tested reusable baby bottles and found that per washing they released between 1.3 million and 16.2 million plastic particles per liter of fluid, which means that every infant consumes 1.6 million MP particles per day on average (Li, 2020). Interestingly the same researchers found that trillions of NP particles are released per washing, which can easily migrate through the body (Li, 2020). In fact, the World Health Organization (WHO) recommends sanitizing baby bottles with 70°C water, which releases 16.2 million MP particles per liter of fluid, and when sanitized at 95°C, it releases 55 million MP particles (Li, 2020). The results are significant as previous research (Cox et al., 2019) indicated adults consumed between 39,000 and 52,000 MP particles annually, which differs significantly

from those found by Trinity College Dublin. The new research suggests increased amounts of ingestion of MP for both babies and adults, which further elucidates the need for more complete research on the possibility of toxicological effects.

General Toxicity

Aside from the neurotoxicity, there exists a large range of toxic effects in fish, invertebrates, and rodents. Most effects can be generalized as: inflammation of the gut, gills, liver, kidney, and muscles, particle accumulation in the intestine, kidneys, gallbladder, and gonads, oxidative damage to the body/organs, reduction of the overall fitness, changes in gene expression, alterations in motility, changes in behavior, dysfunction of the intestinal barrier and gut microbiome, and increased mortality (Prüst et al., 2020). For a more complete listing of non-neuronal effects for non-mammals see (Rubio, et al. 2019; Yong et al., 2020; Wang et al., 2020; Prüst et al., 2020).

The number of studies utilizing mouse models has increased, but there is still a great need for further research on the health effects of MPs and NPs. Overall, it has been shown in various studies that MPs and NPs are found in the liver, kidney, and gut in rodents (Yong et al., 2020). Similarly, a reduction in mucus secretion, gut barrier dysfunction, microbiota dysfunction, and intestinal inflammation have been observed (Yong et al., 2020). Interestingly, some issues with metabolism have also been noted: general energy metabolism dysfunction, lipid accumulation in the liver, changes of the lipid profiles, and dysfunction in bile acid metabolism (Yong et al., 2020). Even with a variety of studies showing changes in physiology and histology, other studies do not observe any detectable inflammatory responses or changes to the tissues (Yong et al., 2020; Stock et al., 2019). Therefore, more research is currently needed to further characterize and solidify findings.

Recently a study has shown that exposure of a pregnant mouse to MPs resulted in metabolic pathologies of the offspring (Yong et al., 2020; Luo, 2019). The toxicology observed in mammals is of lesser intensity than that of fish and invertebrates, but still retains a toxicity that is dependent on plastic size, polymer type, dose, and tissue uptake kinetics (Yong et al., 2020). It has been proposed that the observed decrease in uptake and toxicity could be due to less exposure routes, since the fish have both gills and intestinal tracks (Yong et al., 2020), while mammals only ingest MPs and NPs. However, mammals also breathe in an estimated 26–130 airborne microplastics per day (Prata, 2018). Similar to the invertebrates, the inhalation of MPs and NPs has been demonstrated to induce lung tissue inflammation (Prata, 2018). If this causes

chronic inflammation in the lungs, it could be at the root of many chronic health conditions.

Even more scarce is data on human cells. Currently only *in vitro* studies exist and in very small numbers. Overall, the cumulative data does not indicate a strong position, but most studies showed reduced cellular uptake with absent or insignificant toxicity unless at high MP or NP concentrations (Yong et al., 2020). However, some cell lines have been shown to have significant toxicity or pathological outcomes: increased production of reactive oxygen species (ROS) in T89 and HeLa cells (Schirinzì et al., 2017), low degrees of toxicity in Caco-2 cells due to polarization of the mitochondria and subsequent inhibition of an ABC binding cassette transporter that acts as a toxin efflux pump (Wu et al., 2019), and increased ROS, TNF-alpha, increased IL-6 production from peripheral blood mononuclear cells (PBMCs), and an increase in histamine degranulation from mast cells (Hwang et al., 2019a, 2019b; Yong et al., 2020). TNF-alpha or Tumor Necrosis Factor Alpha is an inflammatory cytokine that is responsible for a large range of inflammation response signaling pathways within other cells (Idriss & Naismith, 2000). Interleukin-6 (IL-6) is a proinflammatory cytokine that is released as a response to injury in the tissues or infection (Tanaka et al., 2014). While increased histamine degranulation means that Mast cells will be releasing more histamine, which is known to cause increased release of IL-6 (Carlos et al., 2006). Therefore, the increased TNF-alpha, reactive oxygen species (ROS), histamine degranulation in mast cells, and IL-6 all suggest an increased immune response as evidenced by the increased inflammatory cytokines (Carlos et al., 2006; Indriss, 2000) (Tanaka et al., 2014).

Overall, experiments using pristine MPs and NPs did not exhibit severe toxic effects on human cells but did show a mildly negative impact that depended on plastic particle size, concentration, and polymer type (Yong et al., 2020). It has been noted that the two most prominent and consistent outcomes due to MP and NP exposure is an increase in ROS and pro-inflammatory cytokine production. (Yong et al., 2020). These studies, however, did not observe the possibility of neurological toxicity, which is explored below.

Neurotoxicity

In vivo

Only two studies exist which explored the effect of MP and NP plastic particles on rodents, which is in stark comparison to the plethora of studies on fish and marine invertebrates. One study chronically exposed male rats for

five weeks to 40 nm polystyrene NPs in a 1–10 mg/kg of body weight per day basis, with no neurobehavior changes observed throughout the study (Rafiee et al., 2017). The authors suggest that this supports the idea of a short-lived and “subtle” effect of NP particles on a human (Rafiee et al., 2017). It must be noted, however, that there was no proof of polystyrene NP uptake in the study (Prüst et al., 2020).

Another study chronically exposed adult mice to 5 μm and 20 μm NP particles in varying doses orally for 30 days (Deng et al., 2017). The researchers found accumulation in the liver, kidney, and gut with tissue specific kinetics resulting in differential accumulation and distribution (Deng et al., 2017). The changes observed in the tissues were dose dependent alterations in metabolism and oxidative stress (Deng et al., 2017). Metabolically the researchers noted decreased ATP with increased lactate dehydrogenase (LDH) which indicates a deficiency in energy due to tissue damage (Deng et al., 2017). Similarly, the researchers also noted a dysregulation of lipid characters and noted increased lipid droplet accumulation in the liver which is a marker for inflammatory responses (Deng et al., 2017; Yong et al., 2020). The researchers also noted increased glutathione peroxidase (GSH-Px), superoxide dismutase (SOD), and catecholamine acetyl transferase (ChAT) which indicate increased oxidative stress. United, the study’s results indicate new evidence that there are adverse effects from the ingestion of MPs (Deng et al., 2017).

In vitro

There are only three studies that have investigated neurotoxicity resulting from MP and NP exposure. Leakage of LDH is a known measure of cytotoxicity that is associated with necrosis and apoptosis. Thus, one study demonstrated that leakage of Lactase Dehydrogenase (LDH) from neurons increased in conjunction with mitochondrial dysfunction due to the administration of polystyrene NPs (55 nm, at 250 mg/L) (Murali et al., 2015), which was consistent with the findings of from the lab of Deng Y Zhang (Deng et al., 2017). Interestingly the Murali lab observed an increase in toxicity as the particles “aged,” which was consistent with Paul (2020) and Oberbeckmann (2020). Finally, the researchers noted that exposure to MPs and NPs resulted in an inhibition of acetylcholinesterase activity and altered neurotransmitters levels, which combined with the already observed increase in ROS may lead to an increased potential for neuronal disorders (Prüst et al., 2020).

Another study used human T98G cerebral cells and human epithelial HeLa cells, which both showed increased ROS production after 24 hours of exposure to the highest polystyrene concentration tested (Schirinzi et al., 2017; Prüst

et al., 2020). The researchers observed no increase in ROS production upon treatment with polyethylene microplastics (Schirinzi et al., 2017; Prüst et al., 2020). The final study used both chronic (18 days, 22.5–360 mg/L) and semi acute (48 hrs, 22.5–1440 mg/L) exposures, which resulted in altered gene expression that indicated oxidative stress, which is consistent with the findings of other studies (Hoelting et al., 2013; Deng et al., 2017; Prüst et al., 2020). Finally, the researchers also noted decreased cell viability at the higher particle concentrations (Hoelting et al., 2013).

Factors that affect Toxicity

Microplastics are known to have toxicity in a dose dependent manner, but the additives and contaminants present on MPs and NPs may be more dangerous than the plastic itself (Yong et al., 2020; Schirinzi et al., 2017; Prüst et al., 2020). Concentration exposure, duration of exposure, and exposure temperature in conjunction with particle characteristics (size, shape, and polymer type) all play a role in neurotoxicity (Prüst et al., 2020). In fact, NPs are generally seen to be taken up more readily than MPs and produce a higher toxic effect (Brown, 2008; WHO, 2019; Prüst et al., 2020). It has been suggested that NPs may be more neurotoxic but have a higher propensity to aggregate and subsequently lower the neurotoxic effect as a result (Prüst et al., 2020). A study let 65 nm particles age, which resulted in sizes greater than 1300 nm that surprisingly had even more of a toxic potential than the original 65 nm particles (Murali et al., 2015). The level of aggregation is likely dependent on the surface charge present, chemical additives, the medium it is suspended in, or the physical characteristics of the environment with which it engages (Prüst et al., 2020). A majority of research with surface charge has been done on metallic nanoparticles. Therefore, more studies utilizing non-metallic MPs and NPs are needed to address this fragment in data. Finally, the protein corona and microbiome present on the particle affect the toxicity (Yong et al., 2020). This is slightly worrisome as MPs and NPs can interact with biological components to increase their availability and reactivity within organisms, particularly blood proteins.

Research investigating MP and NP uptake is primarily done using pristine (virgin) plastics (Paul et al., 2020). This is helpful in controlling for variables but may not provide a complete picture as during the plastic lifecycle it will undergo aging or weathering which refers to a change in the properties of the polymer (Paul et al., 2020). The plastic may undergo a change in the surface properties, physical integrity, or polymer composition, which can occur through a variety of mechanisms: swelling, mechanical wearing, hydrolysis,

photo activated oxidation, biological degradation, pollutant adsorption, release of additives, colonization by microorganisms, or the creation of a protein corona. (Paul et al., 2020).

A complex mixture of polymer type and environment conditions will ultimately control the level of degradation (Paul et al., 2020). The creation of a protein corona contributes to the aging of plastics and is suggested to have different compositions depending on the biological environment which will ultimately control the biological activity (Gruber et al., 2020; Paul et al., 2020; Wolfram et al., 2014). The proteins will associate with the plastic polymer by using van-der-Waals, hydrogen bonding, electrostatic, and hydrophobic interactions (Wolfram et al., 2014). A study found that the protein corona is rapidly formed in less than a minute, and this will affect hemolysis, activation of thrombocytes, endothelial cell death and nanoparticle uptake (Tenzer et al., 2013).

As stated previously, the protein corona composition is largely dictated by the polymer type and the environment, which is backed up by a study that showed different protein compositions when using either human, rat, sheep, and rabbit blood (Tenzer et al., 2013; Wolfram et al., 2014; Müller et al., 2018). Similarly, the food, exposure time, and the formation of a biofilm will affect a polymer's biological interaction (Paul et al., 2020) (Oberbeckmann, 2020). The accumulation of microorganisms on plastic is known as the *plastisphere* (Oberbeckmann, 2020). Due to the higher surface area of MPs they are a potential vehicle for pathogenic microorganisms to attach to and travel greater distances than previously possible. (Oberbeckmann, 2020). Some studies claim that the pathogenic genus *Vibrio* is preferentially colonizing MPs, but other studies dispute this claim (Oberbeckman, 2020). Similarly, MPs could act as a long-term colonization option, however the data on this is still developing and regardless of the outcome the researchers call for better plastic management going forward (Oberbeckman, 2020).

Introduction

Currently when microplastics wash down the drain, they are not filtered by conventional filtering methods. Roughly 79% of MPs are filtered when using biofilters, while significantly less NPs are filtered during treatment (Liu et al., 2020). Not all wastewater treatment plants (WWTPs) use biofilters as most filtration systems were created before the pervasiveness of microplastics was known. Currently there is a plateau of industrial filtration technology due to inherent material limitations which may require a new approach. However, several filtration technologies such as Microfiltration, Ultrafiltration, Nanofil-

tration, and Reverse Osmosis all can effectively filter both MPs and NPs (Tang & Hadibarata, 2021). However, these techniques have several disadvantages. Some WWTPs equipped with those technologies can filter both MPs and NPs, but conventional filtration systems have five main issues:

- They foul quickly
- They require regular cleaning
- They have short lifetimes
- They are potentially inefficient
- They are costly to make and upkeep

With membrane pores becoming smaller as seen with the move from microfiltration to nanofiltration, the membranes become easier to foul. Nanofiltration has pores on the magnitude of 1–10 nm, which is incredibly susceptible to fouling due to any number of pollutants (Werber et al., 2016). This requires immediate cleaning with harsh chemicals that will in turn shorten the life of the filter even further (Werber et al., 2016). This cleaning requires the filter to be non-operational during the procedure, and decreases efficiency, while increasing cost, energy use, materials, and financial burden required for normal operation (Werber et al., 2016). However, it is also vital that the companies that produce the highly concentrated wastewater be responsible for treating it before releasing it into the environment. Though the technology exists to filter out MPs and NPs no technology exists that is able to do it with above 80% filtration rate while also remaining cheap.

In contrast to conventional filters, free standing liquid membranes (FSLMs) have four potential main advantages:

- The size of particles trapped by the membrane can be finely tuned by changing proportions of the components that comprise it. This can be done by altering the surface tensions of the solution via the concentration of added surfactant.
- Angling the membrane will permit the captured contaminants to slough and fall off at the lowest point of the angled filter which makes it non-fouling (Figure 1).
- The membrane contains self-healing properties as it ideally comprises micelles, which are amphiphathic and allows it to interact with varying electrostatically charged particulates
- FSLMs are cheap to produce and maintain as they can use any number of surfactants and hygroscopic agents. All chemicals needed are low cost and additionally do not require damaging/expensive cleaning procedures which allows their operation to be in theory continuous provided the membrane is not broken.

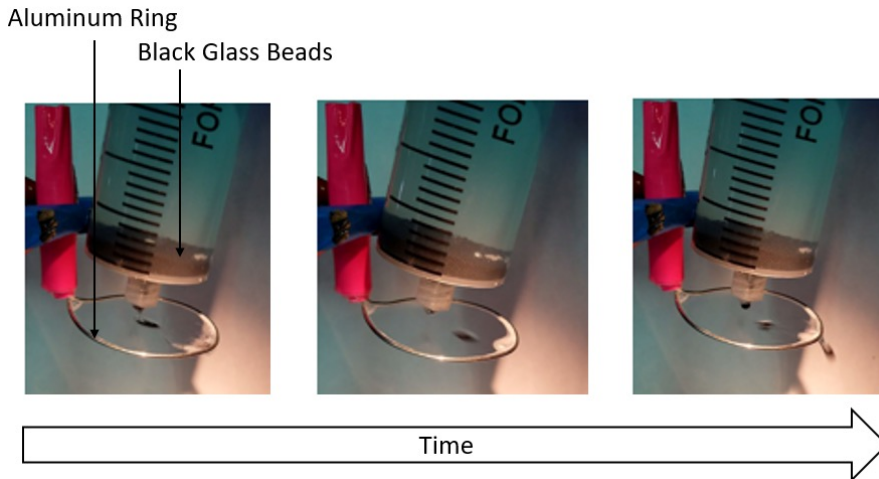


Figure 1: Demonstration of Filtrate Retention. This was captured on the old system but is a good visualization of the path that MPs take during filtration. This was chosen as no other videos taken were able to capture MPs being filtered since they were uncolored and too small to see.

Methods

PRELIMINARY STUDY

Membrane Optimization

To test if a liquid membrane can be used for filtration, it must first be sufficiently stable. Soap solutions must be left to age for at least 24 hours before their use (Dewar, 1925). This was tested in this preliminary study and observed to be accurate. Therefore, all soap solutions tested were prepared and left to sit for at least 24 hours before being used. A preliminary study conducted previously tested sodium dodecyl sulfate (SDS), Dawn Ultra®, and a 50:50 mixture for its longevity. Longevity is representative of the membrane strength and robustness and is measured in seconds. The preliminary study used a 1:25 ratio where 1 gram or milliliter was added until the total volume was 25 ml. A ring holder was created to suspend a crude ring that was fashioned from 1 mm thick aluminum wire and had a 4 cm internal diameter. The soap solutions were poured into a petri dish, which the aluminum ring was submerged into for 5 seconds. The ring was then placed on the ring holder while measuring the time upon exit of the ring from the petri dish. Throughout testing the ring was stationary and no additional solution was added. Once the membrane

collapsed the timer was stopped and the longevity was recorded.

Optimization of SDS Concentration

Various amounts of SDS were weighed and solvated until the volume was 25 ml to identify the most stable concentration of SDS. The same aluminum ring was used, and all samples were measured using the procedure explained above. Seven SDS concentrations were tested. They are denoted S1-S7. S1 used 31.25 mg and had a molarity of 4.33 mM; S2 used 62.5 mg and had a molarity of 8.67 mM; S3 used 125 mg and had a molarity of 17.34 mM; S4 used 250 mg and had a molarity of 34.7 mM; S5 used 500 mg and had a molarity of 69.4 mM; S6 used 750 mg and had a molarity of 104 mM; and S7 used 1000 mg and had a molarity of 139 mM.

Optimization of SDS and Glycerol

All samples S1-S7 were tested with six different glycerol amounts, denoted G1-G6. G1 used 0.25 ml; G2 used 0.50 ml; G3 used 0.75 ml; G4 used 1 ml; G5 used 2 ml; and G6 used 3 ml. The membrane longevity was recorded using the same procedure above and the results were averaged.

Optimization of Replacement Fluid Flow Rate

A burette filled with the same molarity as the membrane fluid was dripped onto the uppermost part of the ring. Fine control of the replacement fluid flow rate proved to be improbable given the equipment, therefore membrane replacement fluid from the burette had to be capped at a flow rate of 6 ml per minute.

Optimization of Contaminated Fluid Flow Rate

The “contaminated fluid” was the fluid being filtered that had MPs present. During the preliminary study, the only way to achieve a stream of water through the membrane was with a 100 ml syringe. The syringe was held one inch normal from the surface of the membrane and shot into a beaker on the other side. After testing, it was observed that an attempted flow rate of 50 ml per minute would be utilized for all proceeding filtration tests since 50 ml/min was chosen over others simply because it was achievable given the tools available to me and it was not too high a flow rate that it would rupture the membrane.

Microplastic Separation Schemes

Filtration tests used 2 mm hemispherical polyethylene glycol (PEO) beads. The beads were first washed in distilled water three times, then dried. This was done to rid the particles of any extraneous contamination. Twelve trials were run with a flow rate of approximately 50 ml per minute for the contaminated

fluid and 4 ml per minute of the replacement fluid. The contaminated fluid was prepared by weighing out 1 g of 2 mm hemispherical PEO beads, then placing them in a 100 ml syringe which was then filled with 30 ml of tap water to suspend the 2 mm MPs. The aluminum ring was 10° from horizontal and the syringe was held normal to the surface of the ring and the contaminated liquid was shot through into a 500 ml beaker on the other side of the membrane. The excess replacement fluid dripped into a separate beaker placed underneath the lowest point of the ring.

After the test was concluded the particles were tabulated by counting each pellet. This was quicker than waiting for them to dry. Then a percentage of recovery was calculated. A second trial was run using the same procedure as above by utilizing shredded polyethylene terephthalate (PET) of amorphous shape. 10 trials were run of the 2 mm HS PEO beads and 5 trials were run of the flat PET particles.

NEW PROCEDURES

Ring Optimization

New rings were printed on an Ender 3 V2 3D printer in PLA with varying heights: 0.2 mm, 0.4 mm, 0.6 mm, and 0.8 mm. They were then compared for changes in longevity. To demonstrate an improvement of the newly designed system over the previous generation, it was imperative to control for other variables such as the environment. To mitigate cross breezes and drafts a box was fashioned with one face missing, in which all tests of comparative membrane longevity were conducted. All rings were dipped into the petri dish for 3 seconds with special care to minimize tilting of the ring before it was loaded onto the holder 10 inches into the box. Once the ring was removed from the petri dish the timer was started. 30 trials were conducted per ring thickness. It should be noted that large tilt angles of the ring will cause it to rupture prematurely if no additional replacement fluid is provided.

Optimization of SDS and Glycerol

Both the new ring that was printed out of white Polylactic Acid (PLA) and the old aluminum ring from the previous study were placed level to the floor. They were placed 10 inches inside the box after being dipped in the petri dish for 3 seconds. Careful precaution was taken to tilt the rings as little as possible between the petri dish and the ring holders. Once the ring was removed from the petri dish the timer was started. Both the old aluminum ring with a diameter of 4 cm and the printed PLA ring with an internal diameter of 3.96 cm were tested in varying concentrations to verify the data originally tabulated

from the old system. 15 trials were conducted per solution.

CSC Interfacial Tensiometer No. 70545 Calibration

A CSC Scientific Company No. 70545 Interfacial Tensiometer was acquired; however, it did not come with the standard Platinum-Iridium ring. Therefore, a suitable replacement had to be fashioned. A substitute ring was printed out of PLA and had an internal and external circumference that averaged to 6.22 cm. This was meant to copy the internal and external 6 cm circumference of the standard Platinum-Iridium ring. Once the tensiometer was unpacked and leveled, the vertical arm was locked by engaging the clamping screw before the ring was attached. This removed any unnecessary strain on the vertical arm assembly. Standard procedure dictates that the ring is heated to a dull red, but since the ring was made of plastic, no heating procedures were utilized, and cleaning was instead a gentle wash with distilled water. The tensiometer calibration goes as follows:

1. Attach the ring to the vertical arm.
2. Release the clamping mechanism screws and the adjustable stops.
3. Adjust the knurled knob on the right-hand side of the tensiometer to ensure the index attached to the vertical arm is perfectly aligned with the reference line on the mirror.
4. Loosen the dial clamp once the index and reference line are exactly in line.
5. Rotate the dial until the zero on the vernier is aligned, then tighten the dial clamp.
6. Use the fine adjustment screw to rotate the dial until the zero on the dial is exactly in line with the zero on the vernier.
7. Place a small piece of paper with a known weight (between 500 and 800 mg) on the ring. The apparent surface tension can be calculated using $p=Mg/2L$, where M is the mass of the weight on the ring in grams, g is the standard acceleration due to gravity and expressed as 980.3 cm/sec^2 , and L is the average value of the internal and external circumference in cm. The surface tension will be expressed in dynes/cm.
8. Align the reference mirror line with the index on the vertical bar once the surface tension has been calculated. Observe the resulting tension reading on the dial. If the recorded reading from the dial is greater than the calculated value by 0.25 dyne/cm or more, the lever arm is slightly shortened. Contrarily, if the recorded dial reading was less than the calculated value by 0.25 dyne/cm or more the lever arm is slightly lengthened.

After calibration was completed, the paper was removed from the ring and

the zero position was readjusted.

Surface Tension Measurements

The sample was poured into a petri dish that was then placed onto the sample plate and raised until the tensiometer ring was just below the surface of the liquid. Then the dish was slowly lowered. Alternating steps of aligning the index and mirror reference line and lowering the sample stage were completed until the ring broke contact with the liquid face. At the breaking point, the dial number was measured, and the system was reset.

Filtering Schemas

For a visual reference, please see Figure 2. Similar to all other tests the membrane solutions were prepared and let to age for 48 hours before usage. The membrane angle was set 10° from horizontal. First, the water spigot on the 4-gal water container was set directly above 1/16 in x 3/4 in x 3 ft aluminum L-bracket, which would terminate approximately 0.5 in above the membrane. The valve on the spicket was adjusted until the flow rate was between 108–140 ml/min. This was measured by simultaneously placing a 100 ml graduated cylinder at the end of the aluminum bracket and starting a stopwatch. The graduated cylinder was removed at approximately 10 seconds and adjusted to a per-minute basis. Once the water flow rate was set, the burette was filled to the top, then a petri dish was filled up 1/3 of the way of the membrane fluid. The petri dish was then lifted to the stage, and the ring was submerged (Figure 2). Upon removal of the petri dish from the suspended ring a membrane formed. A flask was placed under the lowest point of the angled ring and the burette flow rate was adjusted until it was at 10–11 ml per minute which is equivalent to 1 ml used every 6–6.5 seconds. The burette has the replacement fluid for the membrane and will prevent it from rupturing during filtration. After the membrane was stable, the ring was put into position whereby the fluid running through it landed into a separate 1000 ml beaker than the beaker meant to capture the excess membrane solution. If the replacement fluid in the burette became low, the fluid captured in the beaker was poured back into the burette and recycled until testing had concluded. The “contaminated” stream was positioned to run approximately 0.25 inches above the lowest part of the ring and care was taken so the fluid that was filtered did not cross into the membrane fluid stream on the membrane. Intersecting these two streams will result in the filtered fluid combining with the membrane fluid and dragging it into the filtrate, which will eventually use up the available membrane fluid quickly.

Once the system was primed, the plastic was kept in a plastic tray that was slowly dumped into the upper part of the aluminum L bracket. The flowing water in the L bracket carried it through the filter. After all of the sample was

used, the burette valve and spigot on the 4-gallon container was turned off. The ring assembly was then slid out from under the aluminum bracket and the remaining membrane fluid in the system was allowed to run through. An example of the system in operation can be found in the citations under (Amuedo, 2021) with a general overview of the layout (Figure 2).

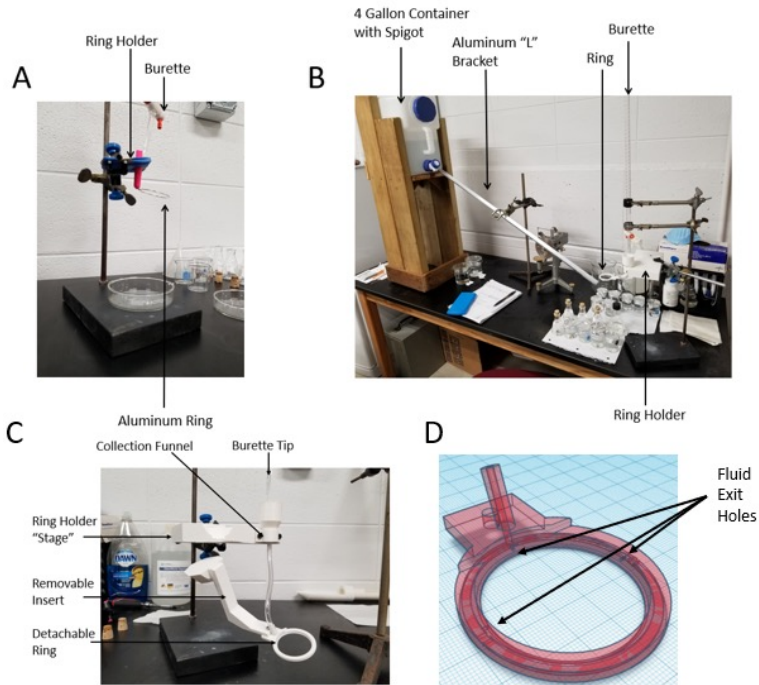


Figure 2: Anatomy of New and Old System. (A) The old system used to gather data for the preliminary study. (B) The New (redesigned) system that was used in this current study. This setup has two independent systems for the contaminated fluid from the 4-gallon tank and replacement fluid from the burette. The ring is 10° from the horizontal. (C) Burette will feed into the collection funnel that feeds replacement fluid through the tube and into the ring. Also demonstrates that the insert is removable, which allows different angles to be used for future testing. (D) Shows the 3D model for the ring so the interior hollow pathways can be seen to better illustrate the pathway of the membrane replacement fluid.

Results

The goal of this experiment is to explore the capabilities of FSLMs as filters by utilizing a redesigned system that will enable more reliable characterization of its properties. To do this, a new system was created and optimized to provide the most stable conditions to ensure the system would be more reliable and ca-

pable. To increase reliable readings, 0.2, 0.4, 0.6, and 0.8 mm ring thicknesses were tested. The 0.2 mm ring provided a median longevity of 45.5 seconds inside the container with a median longevity of 30 seconds outside the container (Table 1A). Similarly, the 0.4, 0.6, and 0.8 mm rings all provided increased membrane longevity and decreased variability when inside the container. The decrease in variability can be observed by the decreased standard deviation when all ring sizes were inside the container (Table 1B). All subsequent membrane longevity tests utilized the container to reduce environmental interference.

Table 1:

A			B		
Ring Thickness	Mean Longevity Inside the Container (sec)	Mean Longevity Outside the Container (sec)	Ring Thickness	Standard Deviation Inside the Container (sec)	Standard Deviation Outside the Container (sec)
0.2 mm	45.7	29	0.2 mm	5.94	8.75
0.4 mm	43.4	30.3	0.4 mm	4.5	8.38
0.6 mm	34.1	32.2	0.6 mm	4.09	5.98
0.8 mm	31.8	28.5	0.8 mm	4.18	6.10

The Effect of Ring Thickness and Environment on Longevity and Consistency. (A) Data gathered by submerging rings in solution for 3 seconds and then placing rings horizontal 10.5 inches from the opening of the container. Thirty trials were conducted for each condition. (B) Analysis of data from inside and outside the container.

Varying SDS content and glycerol content were tested to observe which combination provided the most stable system for further experimental use (Table 2). Higher SDS concentrations tested in the preliminary study were not retested for longevity due to time constraints and since the previous data already consistently showed that increased SDS would decrease membrane longevity. Similarly, the samples with elevated SDS have historically been too unstable to use as a filter anyway, therefore only S1–S3 were tested. Most notable is that S1G6 was significantly more stable than every other solution tested, with one test lasting approximately 2,100 seconds or 35 minutes. Similarly, when plotted there are marginal increases in stability starting at G0 up until the G4, and on both systems, there is a bump in stability that occurs at the G5 content. This is followed by a dip in stability at G6 and a rapid increase in membrane longevity occurring during G7 (Figure 3B).

Table 2:

		SDS Content					
		S1 31.25mg 4.33mM		S2 62.5mg 8.57mM		S3 125 mg 17.34 mM	
Glycerol Content	G0	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)
		80	37	82	42	62	33
	G1	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)
		85	51	91	42	68	43
	G2	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)
		73	50	87	43	65	43
	G3	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)
97		55	89	63	67	31	
G4	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	
	117	116	92.5	61	73	46	
G5	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	
	60	55	60	55	86	61	
G6	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	NS Med (s)	OS Med (s)	
	741	146	192	76	91	63	

Comparison of New and Old Systems Across Varying SDS/Glycerol Contents.

S1-S3 are representative of SDS Samples 1 through 3, while G0-G6 are representative of Glycerol contents 1 through 6. G0 had 0ml of glycerol and G1-6 had 0.25ml, 0.5ml, 0.75ml, 1ml, 2ml, and 3ml respectively. NS Med (s) is the median longevity of the membrane in seconds for the new system, while OS Med (s) is the median longevity of the membrane in seconds of the old system. All tests were performed using the same 0.2mm PLA ring and were held horizontal during testing. S4-S7 were not tested again because the previous study showed a clear and dramatic decrease in membrane stability as the SDS content increased beyond S3.

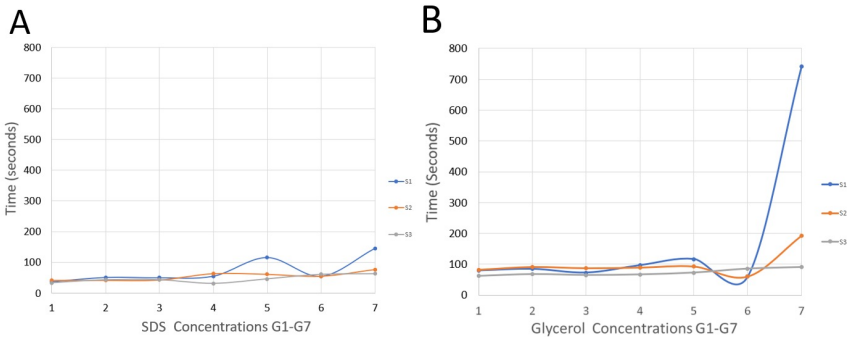


Figure 3: Membrane Longevities across all Glycerol and SDS contents in Both New/Old Systems. (A) The Aluminum ring was dipped in the petri dish filled with solution for 3 seconds and then placed in the stage to suspend it horizontally. (B) The PLA ring was dipped into the petri dish filled with the same solution for 3 seconds and then placed so it was horizontally suspended.

After the three most stable solutions were identified, S1G6, S2G6, and S3G6 were tested alongside all S1-S7 and G1-G6 samples for trends in surface tension (Figure 4). There was a slight decrease in surface tension upon the addition of more glycerol, but more drastic is the change in surface tension from standard distilled water (S1=99.9 dyne/cm) down to 61.2 dyne/cm upon the

addition of only 31.25 mg of SDS (Figure 4).

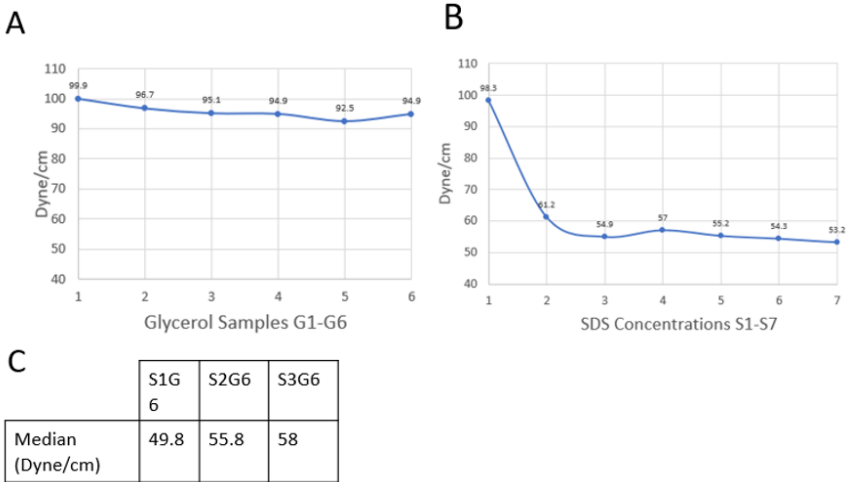


Figure 4: Changes in Surface Tension with Varying SDS or Glycerol Contents. (A) Measurements were taken with the CSC DuNouy 70545 Tensiometer and a 3D printed PLA measuring ring. The tensiometer was utilized to observe any trends in the surface tension upon the addition of more glycerol to distilled water. G1 had 0.25ml of glycerol, G2 had 0.5ml, G3, had 0.75ml, G4 had 1ml, G5 had 2ml, and G6 had 3ml of glycerol. (B), addition of more SDS to distilled water: S1 had 0mg of SDS, S2 had 31.25mg, S3 had 62.5mg, S4 had 125mg, S5 had 500mg, S6 had 750mg and S7 had 1000mg of SDS (C), and amongst the three most stable solutions previously tested. A Dyne/cm is standard unit of force but is equivalent to 10E-5 Newtons.

The system was tested for 5 minutes at 15 ml/min, 22 ml/min, 66 ml/min, 121 ml/min, 248 ml/min, 347 ml/min, 588 ml/min, and 956 ml/min contaminated flow rates to observe if the membrane would be stable under increased filtration speeds. The membrane lasted for the 5-minute duration at all flow rates, but was observed to increase replacement fluid usage at flow rates above 248 ml/min. It was also found that at 3 ml of replacement fluid are irreversibly used per 635 ml of contaminated fluid that is run through the membrane. This equates to roughly 1 gallon of replacement fluid lost per 211 gallons of fluid run through the membrane. The new system may be substantially more stable, but it does show a decreased filtering capacity compared to preliminary results. Trials using the membrane solution of S2G6 filtered 3 mm HS PEO at 15% filtration capability, while also achieving the highest PET filtration rate of 13% (Figure 5). The S1G6 solution had a filtration capacity of 12.7% for PET, but a drastically decreased capacity of only 7% for the 3 mm HS PEO particles (Figure 5). Meanwhile the S3G6 had a 4% success rate for the 3 mm HS PEO particles and a 1% success rate for the PET particles (Figure 5). No solution was able to effectively filter 2 mm, 5 mm, or 4 mm HS PEO particles likely due to being too heavy to be retained by the membrane.

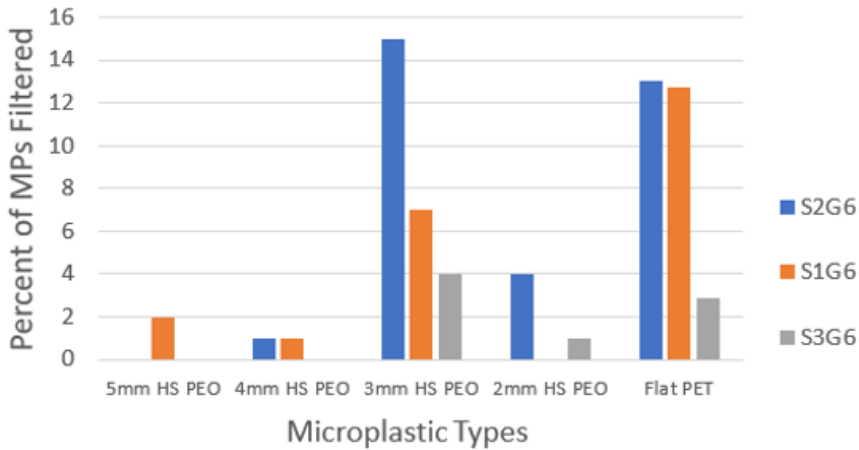


Figure 5: Plastic Separation Using Varying Solutions and Plastic Sizes. HS stands for Hemi-spherical, PEO is Polyethylene glycol, and PET is Polyethylene terephthalate.

Discussion

This experiment aimed to create a better system that would provide more consistent results and reduce the potential for human error while further characterizing FSLMs ability to filter MPs from water. The preliminary study only tested 2 mm HS PEO beads and the heterogenous flat PET particles with median MP capture rates of 60.4% and 47.5% respectively. However, the previous methodology provided substantial variability across all data, which was drastically reduced throughout this study as demonstrated throughout the study. In comparison to the previous study, this follow-up study observed a drastic decrease in 2 mm HS PEO filtration success as well as flat PET particles, with respective captures of 4% and 12.7% using the S1G6 solution. However, the much higher capture rates reported in the preliminary results were likely artificially high due to faulty testing procedures. Surprisingly, 3 mm HS PEO beads were filtered most successfully at filtration rate of 15% when using the S2G6 solution (Figure 5). The decrease in filtration capacity is likely due to human error in the original findings, since the old system was unable to be tested continuously for more than 2 minutes and often failed completely by popping. Meanwhile the new system was successfully tested for 1 hour with both replacement fluid and “contaminated” fluid being run through the membrane until the test was stopped prematurely due to time constraints. The ultimate amount of time the system can last given only 400 ml replacement fluid is currently unknown. Therefore, the new system is clearly more stable than the previous generation and is not the cause of decreased filtering capacity.

The measurement of surface tension did provide noticeable trends, but the absolute values of those measurements are incorrect. The platinum-iridium ring required to acquire accurate measurements was prohibitively expensive, and thus the closest substitute that could be constructed was made from PLA. However, the platinum-iridium alloy has a wettability constant that is optimal due to its high surface free energy, which allows it to form a contact angle of 0° , whereas plastics generally have rather low wettability constants as they are hydrophobic and will likely produce a less than optimal contact angle, which will subsequently change the surface tensions it records. The surface tension decreases as more SDS and glycerol are added, but one would expect to see surface tension decrease as SDS increases in the S1G6-S3G6 samples (Figure 4). SDS will disrupt the hydrogen bonds between water molecules leading to a lower surface tension, but as the SDS concentration increases from S1G6 to S3G6 the surface tension increases (Figure 4C). This is unexpected and indicates that some other factor is working to dictate the apparent surface tension such as the material chosen to make the replacement ring having a larger impact than expected. Finally, it must be noted that none of the values recorded with the tensiometer were corrected using the correction factor as the contact angle was required for calculation and this could not be obtained with the equipment available.

The preliminary study found that the most stable solution was S2G6, but this study identified that the most stable solution was S1G6 by a wide margin (Figure 3B). The preliminary study only tested each solution 5 times, but this study tested them all 15 times except all S1G6-S3G6 solutions were only tested 8 times each since S1G6 tests lasted as long as 35 minutes.

Overall, the data suggests that the new system is significantly more stable than the previous generation and has differential filtration capabilities based on the MP or solution used. Current data suggests filtration capabilities based on MP size, shape, polymer type, and mass. However, no experiments have been done to further prove this hypothesis. No significant amount of 5 mm, 4 mm, or 2 mm HS MP particles were filtered out, however, this could be either due to limitations of the system, or due to the higher weight of the HS MPs. The heterogeneous PET particles are flat and thus have a higher surface area per mass ratio than the HS PEO particles as they have more mass per size than the PET particles. Future studies that wish to enumerate this system can test PEO plastic again, but as flat MP particles that have less mass. Similarly, different plastic types, shapes, sizes, and ages can all be tested in future studies. Future experiments need to acquire accurate surface tensions and correlate them with filtration capability at varying sizes to look for possible relationships, as this study was unable to provide a relationship with captured data. Different sur-

factants such as cationic/anionic surfactants could be used with varying hygroscopic agents for different membrane properties, which could better characterize the tunability of FSLMs. Additionally, different ring constructions will also need to be explored to further increase the system stability and filtration capacity. Finally, if the membranes prove to be tunable, multi-ring systems composed of differentially tuned solutions could be used to target varying MP types and sizes. Overall, this new system did provide a more sustainable system that provided more reliable data than the previous generation, though its filtration capacity is still not well characterized enough to establish it as a current solution.

REFERENCES

- Alimi, O. S., Budarz, J. F., Hernandez, L. M., & Tufenkji, N. (2018). Microplastics and nanoplastics in aquatic environments: aggregation, deposition, and enhanced contaminant transport, *Environ. Sci. Technol.*, 52 (2018), 1704–1724, doi: 10.1021/acs.est.7b05559.
- Amuedo, D. (2021). Free-standing liquid membrane (generation 2: follow-up study) system operation example. YouTube, https://youtu.be/BPPKBM1_XHQ.
- Andrady, A. L. (2011). Microplastics in the marine environment. *Marine pollution* 62(8), 1596–1605. doi: 10.1016/j.marpolbul.2011.05.030.
- Barboza, L. G. A., Dick Vethaak, A., Lavorante, B. R. B. O., Lundebye, A. K., & Guilhermino, L. (2018). Marine microplastic debris: An emerging issue for food security, food safety and human health. *Marine pollution bulletin*, 133, 336–348. <https://doi.org/10.1016/j.marpolbul.2018.05.047>
- Biolin Scientific. “Critical Micelle Concentration.” Measurements, www.biolinscientific.com/measurements/critical-micelle-concentration.
- Bruck, S. & Ford, A. T. (2018). Chronic ingestion of polystyrene microparticles in low doses has no effect on food consumption and growth to the intertidal amphipod *Echinogammarus marinus*? *Environmental pollution* 233, 1125–1130. doi: 10.1016/j.envpol.2017.10.015.
- Carlos, D., Sá-Nunes, A., de Paula, L., Matias-Peres, C., Jamur, M. C., Oliver, C., ... Faccioli, L. H. (2006). Histamine modulates mast cell degranulation through an indirect mechanism in a model IgE-mediated reaction. *European Journal of Immunology* 36(6) 1494–503. doi: 10.1002/eji.200535464. PMID: 16703563.
- Cox, K. D., Covernton, G. A., Davies, H. L., Dower, J. F., Juanes, F., & Dudas, S. E. (2019). Human Consumption of Microplastics. *Environmental science & technology*, 53(12), 7068–7074. <https://doi.org/10.1021/acs.est.9b01517>.

- Deng Y., Zhang Y., Lemos, B., & Ren, H. (2017). Tissue accumulation of microplastics in mice and biomarker responses suggest widespread health risks of exposure. *Scientific Reports* 7, article 46687. doi: 10.1038/srep46687.
- Fendall, L. S. & Sewell, M. A. (2009). Contributing to marine pollution by washing your face: microplastics in facial cleansers. *Marine pollution bulletin* 58, 1225–1228, doi: 10.1016/j.marpolbul.2009.04.025.
- Galloway, T. S. (2015). Micro-and nano-plastics and human health. In: Bergmann, M., Gutow, L., & KLages, M. (eds). *Marine Anthropogenic Litter* Springer: Cham, Germany, 343–366. doi: 10.1007/978-3-319-16510-3_13.
- Gewert, B., Plassmann, M. M. & MacLeod, M. (2015). Pathways for degradation of plastic polymers floating in the marine environment. *Environmental Science: Processes & Impacts* 17, 1513–1521. doi: 10.1039/C5EM00207A.
- Geyer, R.; Jambeck, J. R., & Law, K. L., (2017). Production, use, and fate of all plastics ever made. *Science Advances* 3(7), [CrossRef] [PubMed] doi: 10.1126/sciadv.1700782.
- Gregory, M. R. (1996). Plastic ‘scrubbers’ in hand cleansers: a further (and minor) source for marine pollution identified. *Marine pollution bulletin* 32(12), 867–871. doi: 10.1016/S0025-326X(96)00047-1.
- Gruber, M.M., Hirschmugl, B., Berger, N., Holter, M., Radulović, S., Leitinger, G., ... Wadsack, C. (2020). Plasma proteins facilitates placental transfer of polystyrene particles. *Journal of Nanobiotechnology* 18, article 128. doi: 10.1186/s12951-020-00676-5.
- Gündoğdu, S. (2018). Contamination of table salts from Turkey with microplastics, *Food Additives & Contaminates. Part A, Chemistry, Analysis, Control, Exposure, and Risk Assessment* 35(5). 1006–1014. doi: 10.1080/19440049.2018.1447694.
- Hernandez, L. M., Xu, E. G., Larsson, H. C. E., Tahara, R., Maisuria, V. B., & Tufenkji, N. (2019). Plastic Teabags Release Billions of Microparticles

- and Nanoparticles into Tea. *Environmental science & technology*, 53(21), 12300–12310. <https://doi.org/10.1021/acs.est.9b02540>.
- Hoelting, L., Scheinhardt, B., Bondarenko, O., Schildknecht, S., Kapitza, M., Tanavde, V., ... Kadereit, S. (2013). A 3-dimensional human embryonic stem cell (hESC)-derived model to detect developmental neurotoxicity of nanoparticles. *Archives of Toxicology* 87, 721–733. doi: 10.1007/s00204-012-0984-2.
- Hwang, J., Choi, D., Han, S., Jung, S. Y., Choi, J., & Hong, J. (2019a). Potential toxicity of polystyrene microplastic particles. *Scientific Reports* 10, article 7391. doi: 10.1038/s41598-020-64464-9.
- Hwang, J.; Choi, D.; Han, S.; Choi, J.; Hong, J. (2019b). An assessment of the toxicity of polypropylene microplastics in human derived cells. *Science of the Total Environment* 684, 657–669. doi: 10.1016/j.scitotenv.2019.05.071.
- Idriss, H. T., Naismith, J. H. (2000) TNF alpha and the TNF receptor superfamily: structure-function relationship(s). *Microscopy Research Technique* 50(3), 184–95. doi: 10.1002/1097-0029(20000801)50:3<184::AID-JEMT2>3.0.CO;2-H. PMID: 10891884.
- Íñiguez, M. E., Conesa, J. A., & Fullana, A. (2017). Microplastics in Spanish table salt, *Scientific Reports* 7, article 8620. doi: 10.1038/s41598-017-09128-x.
- Jambeck, J. R., Geyer, R., Wilcox C., Siegler, T. R., Perryman, M., Andrady, A., ... Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science* 467 (6223), 768–771. doi: 10.1126/science.1260352.
- Karami, A., Golieskardi, A., Choo, K. C., Larat, V., Galloway, T. S., & Salamatinia B. (2017). The presence of microplastics in commercial salts from different countries, *Scientific Reports* 7, article 46173. doi: 10.1038/srep46173.
- Kosuth, M., Mason, S. A., & Wattenberg, E. V. (2018). Anthropogenic contamination of tap water, beer, and sea salt, *PLoS One* 13(4), article

e0194970. doi: 10.1371/journal.pone.0194970.

- Li, D., Shi, Y., Yang, L., Yang, L., Xiao, L., Kehoe, D. K., Gun'ko, Y. K., ... Wang, J. J. (2020). Microplastic release from the degradation of polypropylene feeding bottles during infant formula preparation. *Nature Food* 1, 746–754. doi: 10.1038/s43016-020-00171-y.
- Liebezeit, G., & Liebezeit, L. (2013). Non-pollen particulates in honey and sugar, *Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure, and Risk Assessment* 30(12) 2136–2140. doi: 10.1080/19440049.2013.843025.
- Liebezeit, G., & Liebezeit, L. (2014). Synthetic particles as contaminants in German beers, *Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure, and Risk Assessment* 31 1574–1578. doi: 10.1080/19440049.2014.945099.
- Liu, F., Nord N. B., Bester, K., & Vollertsen, J. (2020). Microplastics removal from treated wastewater by a biofilter. *Water* 12(4). doi: 10.3390/w12041085.
- Luo, T., Wang, C., Pan, Z., Jin, C., Fu, Z., & Jin, Y. (2019). Maternal polystyrene microplastic exposure during gestation and lactation altered metabolic homeostasis in the dams and their F1 and F2 offspring. *Environmental Science & Technology* 53, 10978–10992. doi: 10.1021/acs.est.9b03191.
- Microplastics: Sources, Effects and Solutions: News: European Parliament. *Microplastics: Sources, Effects and Solutions: News: European Parliament*, 22 Nov. 2018, www.europarl.europa.eu/news/en/headlines/society/20181116S-TO19217/microplastics-sources-effects-and-solutions.
- Microplastics: Your Environment, Your Health: National Library of Medicine. U.S. National Library of Medicine, National Institutes of Health, toxtown.nlm.nih.gov/sources-of-exposure/microplastics.
- Müller, K. L., Simon, J., Rosenauer, C., Mailänder, V., Morsbach, S., & Landfester, K. (2017). The transferability from animal models to humans: chal-

- lenges regarding aggregation and protein corona formation of nanoparticles, *Biomacromolecules* 19(2), 374–385. doi: 10.1021/acs.biomac.7b01492.
- Murali, K., Kenesei, K., Li, Y., Demeter, K., Környei, Z., & Madarász, E. (2015). Uptake and bio-reactivity of polystyrene nanoparticles is affected by surface modifications, ageing and LPS adsorption: in vitro studies on neural tissue cells. *Nanoscale* 9(7), 4199–4210. doi: 10.1039/c4nr06849a..
- Napper, I. E., Bakir, A., Rowland, S. J., & Thompson, R. C. (2015). Characterisation, quantity and sorptive properties of microplastics extracted from cosmetics. *Marine Pollution Bulletin* 99, (1–2), 178–185. doi: 10.1016/j.marpolbul.2015.07.029.
- Oberbeckmann, S., & Labrenz, M. (2020). Marine microbial assemblages on microplastics: diversity, adaptation, and role in degradation, *Annual Review of Marine Science* 12, 209–232. doi: 10.1146/annurev-marine-010419-010633.
- Paul, M. B., Stock, V., Cara-Carmona, J., Lisicki, E., Shopova, S., Fessard, V., ... Böhmert, L. (2020). Micro- and nanoplastics-current state of knowledge with the focus on oral uptake and toxicity. *Nanoscale Advances* 2 4350–4367. doi: 10.1039/d0na00539h.
- Peeken, I., Primpke S., Beyer, B., Gütermann, J., Katlein. C., Krumpfen, T., ... Gerdt, G. (2018). Arctic sea ice is an important temporal sink and means of transport for microplastic. *Nature Communications* 9(1), article 1505. doi: 10.1038/s41467-018-03825-5. PMID: 29692405; PMCID: PMC5915590.
- Plastics-the facts 2018: an analysis of European plastics production, demand and waste data (2017). *Plastics Europe*, <https://www.plasticseurope.org/en/resources/publications/619-plastics-facts-2018>.
- Prata, J. C. (2018). Airborne microplastics: consequences to human health? *Environmental Pollution* 234, 115–126. doi: 10.1016/j.envpol.2017.11.043. PMID: 29172041.

- Prüst, M., Meijer, J., & Westerink, R. H. S. (2020). The plastic brain: neurotoxicity of micro- and nanoplastics. *Particle Fibre Toxicology* 17(24). doi: 10.1186/s12989-020-00358-y.
- Rafiee, M., Dargahi, L., Eslami, A., Beirami, E., Jahangiri-rad, M., Sabour, S., & Amereh, F. (2017) Neurobehavioral assessment of rats exposed to pristine polystyrene nanoplastics upon oral exposure. *Chemosphere* 193, 745–753. doi: 10.1016/j.chemosphere.2017.11.076.
- Revel, M., Châtel, A., & Mouneyrac, C. (2018). Micro(nano) plastics: a threat to human health? *Current Opinion Environmental Science & Health* 1, 17–23. doi: 10.1016/j.coesh.2017.10.003.
- Rochman, C., Browne, M., Halpern, B., Hentschel, B. T., Hoh, E., Karapanagioti, H. K., ... Thompson, R. C. (2013). Classify plastic waste as hazardous. *Nature* 494, 169–171. doi: 10.1038/494169a.
- Rogers, K. (2022). Microplastics. *Encyclopædia Britannica*, Encyclopædia Britannica, Inc., www.britannica.com/technology/microplastic.
- Rubio, L., Marcos, R., & Hernández, A. (2019). Potential adverse health effects of ingested micro-and nanoplastics on humans. Lessons learned from in vivo and in vitro mammalian models. *Journal of Toxicology and Environmental Health, Part B* 23 (2) 51–68. doi: 10.1080/10937404.2019.1700598.
- Schirinzi, G. F., Pérez-Pomeda, I., Sanchís, J., Rossini, C., Farré, M., & Barceló, D. (2017). Cytotoxic effects of commonly used nanomaterials and microplastics on cerebral and epithelial human cells. *Environmental Research* 159, 579–587. doi: 10.1016/j.envres.2017.08.043.
- Schwabl P., Köppel, S., Königshofer, P., Bucsics, T., Trauner, M., Reiberger, T., & Liebmann, B. (2019). Detection of various microplastics in human stool: a prospective case series. *Annals of Internal Medicine* 171(7) 453–457. doi: 10.7326/M19-0618. PMID: 31476765.
- Schymanski, D. Goldbeck, C., Humpf, H. U., & Fürst P. (2018). Analysis of microplastics in water by micro-Raman spectroscopy: release of plastic

- particles from different packaging into mineral water, *Water Research* 129, 154–162. doi: 10.1016/j.watres.2017.11.011.
- Sharma, S. & Chatterjee, S. (2017). Microplastic pollution, a threat to marine ecosystem and human health: a short review. *Environmental Science and Pollution Research* 24, 21530–21547. doi: 10.1007/s11356-017-9910-8.
- Stock, V., Böhmert, L., Lisicki, E., Block, R., Cara-Carmona, J., Pack, L.K., ... Lampen, A. (2019). Uptake and effects of orally ingested polystyrene microplastic particles in vitro and in vivo. *Archives of Toxicology* 93(7), 1817–1833. doi: 10.1007/s00204-019-02478-7.
- Storck, F. R., Kools, S. A. E., & Rinck-Pfeiffer, S. (2015). Microplastics in fresh water resources. *Global Water Research Coalition*, Stirling, South Australia, Australia, http://www.globalwaterresearchcoalition.net/_r2618/media/system/attrib/file/705/GWRC%20Science%20Brief%20Microplastics%20%28September%202015%29.pdf.
- Sussarellu, R., Suquet, M., Thomas, Y., Lambert, C., Fabioux, C., Pernet, M. E. J., ... Huvet A. (2016). Oyster reproduction is affected by exposure to polystyrene microplastics. *Proceedings of the National Academy of Sciences* 113 (9), 2430–2435. DOI: 10.1073/pnas.1519019113.
- Tanaka, T., Narazaki, M., & Kishimoto, T. (2014). IL-6 in inflammation, immunity, and disease. *Cold Spring Harbor Perspectives in Biology* 6(10). doi: 10.1101/cshperspect.a016295.
- Tang, K. H. D., & Hadibarata, T. (2021). Microplastics removal through water treatment plants: its feasibility, efficiency, future prospects and enhancement by proper waste management. *Environmental Challenges* 5. doi: 10.1016/j.envc.2021.100264t.
- Tenzer S., Docter, D., Kuharev, J., Musyanovych, A., Fetz, V., Hecht, R., ... Stauber, R. H. (2013). Rapid formation of plasma protein corona critically affects nanoparticle pathophysiology. *Nature Nanotechnology* 8(10), 772–81. doi: 10.1038/nnano.2013.181. PMID: 24056901.

- What Are Microplastics? (2016). United States Department of Commerce and National Oceanic and Atmospheric Administration. *NOAA's National Ocean Service*, oceanservice.noaa.gov/facts/microplastics.html.
- Wang, Y. L., Lee, Y. H., Chiu, I. J., Lin, Y. F., & Chiu, H. W. (2020). Potent impact of plastic nanomaterials and micromaterials on the food chain and human health. *International Journal of Molecular Sciences* 21(5), 1727. doi: 10.3390/ijms21051727.
- Werber, J. R., Osuji, C. O., & Elimelech, M. (2016). Erratum: materials for next-generation desalination and water purification membranes. *Nature Reviews Materials*, article 16037. doi: 10.1038/natrevmats.2016.37.
- Wolfram, J., Yang, Y., Shen, J., Moten, A., Chen, C., Shen, H., ... Ziao, Y. (2014). The nano-plasma interface: implications of the protein corona. *Colloids and Surfaces B: Biointerfaces* 124, 17–24. doi: 10.1016/j.colsurfb.2014.02.035.
- World Health Organization. (2019). Microplastics in drinking-water. <https://www.who.int/publications/i/item/9789241516198>.
- Wu, B., Wu, X., Liu, S., Wang, Z., Chen, L. (2019). Size-dependent effects of polystyrene microplastics on cytotoxicity and efflux pump inhibition in human Caco-2 cells. *Chemosphere* 221, 333–341. doi: 10.1016/j.chemosphere.2019.01.056.
- Yang, D., Huahong, S., Li, L., Li, J., Jabeen, K., & Kolandhasamy, P. (2015). Microplastic pollution in table salts from China. *Environmental Science & Technology* 49 (22), 13622–13627. doi: 10.1021/acs.est.5b03163.
- Yong, C. Q. Y., Valiyaveetil, S., & Tang, B. L. (2020). Toxicity of microplastics and nanoplastics in mammalian systems. *International Journal of Environmental Research and Public Health* 17(5), 1509. doi: 10.3390/ijerph17051509.
- Zalasiewicz, J., Waters, C., Ivar do Sul, J. A., Corcoran, P. L., Barnosky, A. D., Cearreta, A. ... Yonan, Y. (2016). The geological cycle of plastics and

their use as a stratigraphic indicator of the Anthropocene. *Anthropocene* 13, 4–17. doi: 10.1016/j.ancene.2016.01.002.

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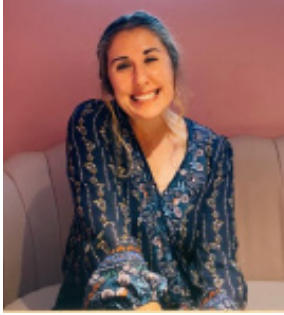
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