Abstract

This study examines how genetic ancestry testing (GAT) companies represent race in regards to different types of connection they allege to provide with their GAT services through their video advertisements. Preliminary analysis identified familial connection, ancestral connection, and ethnic/cultural connection as three main types of connection that GAT advertisements feature. Ninety advertisements from three Anglophone GAT companies (23andMe, AncestryDNA and MyHeritageDNA) were coded for these themes and for the representation of subject's racial identity. The resulting data suggests that the advertisements grossly over-represent white subjects in all three thematic categories and particularly in the categories of current family and ethnic/cultural identity. These results, combined with our qualitative analysis, lead us to conclude that GAT advertisements market a white-centric notion of genetic interconnectivity that promotes identity cherry-picking and conflates genetic data with identity and social, cultural, and familial kinship.

Research Question:

Do GAT advertisements under or over represent subjects of certain races in their portrayal of themes surrounding ethnic/cultural identity, family ties, and ancestry? Other studies have examined consumer reception of GAT results and found they exhibit racial fetishization and identity cherry-picking. We hypothesize that this phenomenon is not unrelated to GAT companies' marketing campaigns, which have heretofore been unstudied.

Background

General genetic testing began in 2001, when the Human Genome Project established a bank for human reference DNA and determined that humans share 99.9% of our DNA. The project spurred conversation about human similarity and connection. Following the completion of the mapping of the genome, scientific interest and funding shifted to analyzing the remaining 0.1% accounting for human diversity, creating a market for modern genetic ancestry testing (GAT) (Letzter, 2018; Terrell, 2018). People who want to know more about their genealogy or family history can turn to GAT to gain insight about their family's ethnic and geographic origins, learn about inherited traits and disease risk, and find genetic family relationships and kinship (U.S. National Library of Medicine, 2019). Today, GAT has become an accessible and popular consumer service. Troy Duster indicated in 2002 that almost 500,000 people pursued genealogy testing (Duster, 2011). In February 2018, an estimated 12 million consumers had their DNA tested (Regalado, 2018). In this report, we explore the ways that GAT companies use advertisements to convey ideas of genetic diversity, connectedness, and kinship.

GAT analyzes patterns in DNA, a double helix chain made of chemical base pairs with abbreviations -- A, C, T, G. Within human cells, DNA is composed of 23 chromosomes, which are units of DNA wrapped around histone proteins like yarn around a spool. DNA sequencing is the process used to determine the order of these letters in a genome.

With a saliva sample or cheek swab from test-takers, GAT companies categorize and upload collected DNA to a central database for analysis. GAT software then "reads" the unique order of base pairs to the individual's DNA. Ancestry information can be tracked through paternal lineages using the Y chromosome passed down from father to son, mitochondrial DNA inherited through maternal lineages, or 22 non-sex determining chromosomes inherited from both parents. Some companies use a statistical algorithm using ancestry-informative markers (AIMS) to compare genetic markers and characterize percentages of DNA into ethnic groups. For instance, if a test determines that a consumer has 29% Italian ancestry, "29 percent of the pieces of [their] DNA" share genetic markers with a reference population of people with similar genetic markers native to Italy (Letzter, 2018). Crucially, the reference groups used to link individual DNA with geographic populations are identified through self-reported consumer data about racial and ethnic identification. Scientists from GAT companies may assign a group with label "Thai" if an algorithm finds that 8,000 people...from a close-knit ancestry group" share similar genetic variants "and the researchers know that all of those people trace their heritage to Thailand" (Letzter 2018). Using these genetic traces, companies claim to track the movement of ancestors over the course of thousands of years; recent statistical genetic analysis links all humans to an ancestor who lived 200,000 years ago dubbed as our "Mitochondrial Eve."

Despite advances in genomic technology, GAT has several technical and scientific limitations. Genetic variation within population gene pools is heavily influenced by geographic genetic drift, or changes in allele frequencies in a population caused by geographic patterns. AIMS algorithms assume that reference populations are immobile, which contradicts early and current human migration patterns, trade, and formation of civilizations (Jobling et. al, 2016). Reference population data based on contemporary populations therefore do not faithfully represent past populations unless the gene pool has been stagnant for centuries and absent elsewhere, which is highly unlikely (Duster, 2011). Furthermore, scientist choose AIMs subjectively. They select markers that vary most distinctively between predefined ancestry groups/clusters--European, African, Asian--which are contingent upon the socially and culturally-based notions of racial categorization (Morning, 2014). As a result, many interpretations of DNA test results are heavily influenced by predetermined cultural and social forces and these companies fail to explain such limitations to their customers, who may easily misinterpret their results as reinforcing race as biological fact (Jobling et al., 2016; Shriver & Kittles, 2004)

Moreover, the sample sizes of some reference populations can be relatively small and the AIMs are unevenly distributed among populations both geographically and size-wise (Roth & Ivemark, 2018). For instance, European populations tend to be sampled much higher relative to other populations leading to much more detailed results for those of European descent. As a result, tests distinguish Irish ancestry from Anglo-Saxon ancestry, but may combine Inuit ancestry and Navajo ancestry into a single result category (Letzter, 2018). Accuracy depends heavily on the existence of a reliable reference population to compare the test-takers' DNA markers with. Also, ethnicity estimates for the same consumer can vary because different companies constitute reference populations based on different algorithms and criteria. Another limitation lays within statistical interpretation. Tests that reference genealogy spanning 10

generations back analyze genetic information with a miniscule influence--about 0.098% contribution (Terrell, 2018).

Finally, these technical and scientific limitations generate ethical concerns over GAT results, as well as the methods companies use to advertise GAT products. Here medical genetic testing (GT) services offers a helpful parallel with GAT. Schaper and Schicktanz found that there are three common themes used by medical GT companies in their marketing and advertising strategy: "(1) the use of material suggesting medical professional legitimacy as a trust-establishing tool, (2) the suggestion of empowerment as a benefit of using DTC GT services and (3) the narrative of responsibility as a persuasive appeal to a moral self-conception." For example, commercials from these GT companies may feature images of a doctor-patient relationship to convey situational ethos but can be misleading because not all companies require physician supervision of GT services. Acknowledging these concerns is important for understanding the relationship between the persuasive goals of the company's advertisements and the techniques used by companies to achieve these goals (Schaper & Schicktanz, 2018).

Literature Review

Race has been generally accepted as a social construction in the social sciences for the past forty-five years (Suzuki et al., 2018). Scholars generally agree that race has no basis in inherent, biological differences, but is instead a socially constructed and culturally enacted concept that emerges from racism and changes over time as political, economic, and historical contexts change (McChesney, 2015; American Sociological Association, 2003).

Evidence of the changing and subjective nature of racial categories support these social construction theories. For example, certain immigrant groups to the United States like Italians and Irish were initially racialized as non-white before being eventually included in the "white" category, showing the historical evolution of the definition of "whiteness" (Hubbard, 2017; Guglielmo & Salerno, 2003). Moreover, race and racial hierarchies are classified differently in every country, based on the different historical, political, and economic histories and contexts of each country (Hubbard, 2017). Scholars also point to science that states that there is more diversity within than between racial groups (McChesney, 2015).

After the completion of the Human Genome Project in 2001 that determined genetic similarity among all humans, doctor Robert Schwartz wrote that "race has become passé" (Schwartz, 2001). However, in the modern post-genomics era, or the period since the completion of the Human Genome Project, there is growing debate between scholars about defining race in the context of biogenetics. The role of biology in racial classification and the usefulness of racial classifications in medicine is being increasingly examined (Abu el-Haj, 2007; Nelson, 2008). This debate complements the recent rise of the commercial genetic genealogy testing industry, which has now become a global multi-billion-dollar industry (Nash, 2015; Marks, 2018).

GAT companies have introduced new controversies to discussions of race and identity, including the incorporation of biology and genetics into the socially-constructed definition of race and its capacity to affect an individual's identity (Hochschild & Sen, 2015). In a survey of genetic ancestry test-takers, around half of the respondents claimed that the results affected their identity, activities, and friendships, Two-fifths claimed the results led them to identify their race or ethnicity differently when test results revealed unexpected ancestry (Roth & Lyon, 2018). Scholars have also suggested that GAT may

promote genetic determinism, the idea that genes alone determine one's race, or even racial essentialism, the idea that races are genetically different in traits and abilities (Bolnick et al., 2007; Duster, 2011; Byrd & Hughey, 2015; Heine, 2017).

Scodari posits that genetic ancestry tests profit off the belief that the biological or genetic aspect of kinship supersedes cultural and social aspects of kinship, despite many scholars noting that kinship and connectivity are multi-layered, reflecting more than just genetics (Scodari, 2017; Marks, 2002; Franklin & McKinnon, 2000). For example, Franklin & McKinnon write that kinship manufactures "lines of relation" through "substantial connections and cultural codings," and Marks mentions that "there is no genetic test for kinship." As a result, test-takers may potentially adopt new, "geneticized" racial and ethnic identities based on their newly discovered genetic kinship, reshaping their prior notions about race and identity (Nelson, 2008). Nelson writes,

> These roots narratives follow a now predictable arc: DNA testing, feelings of completion, and the assumption of the subject's unwavering confidence in the genetic test outcome... Social categories such as 'race' and ethnicity are being made anew from the whole cloth of As, Cs, Gs, and Ts.

The tests also frequently promote the idea of connectedness and relatedness amongst people on the basis of genetic similarity, which ironically emphasize differences along the same logic of genetic dissimilarity (Nash, 2015).

Different communities will construct varying meanings of DNA test results according to social appraisals and prior racialization experiences (Roth & Ivemark, 2018). For example, Nelson suggests that the tests may give adoptees a "scientifically validated connection to blood relatives" and may give African Americans "a feeling of connection to Africa prior to the erasure of their history by slavery (Nelson, 2016). White test-takers may also be more likely than nonwhite test-takers to claim multiracial identities as a means of making themselves more unique or exotic (Roth & Ivemark, 2018). White supremacists, however, tended to delegitimize genetic results challenging their notions of white "racial purity" (Panofsky & Donovan, 2017).

Valuable qualitative research has evaluated the motivations of test-takers and the impacts the results have on their racial and ethnic identities. However, little research to date has examined the ways genetic ancestry companies frame their marketing messaging to consumers through video advertisements and how the themes discussed above are represented, or potentially racialized, in these advertisements. Given this gap in the present literature, we employed visual content analysis in our study to analyze ninety advertisements from three of the most popular and widely used genetic ancestry companies: 23andMe, AncestryDNA, and MyHeritage DNA. **We sought to answer the following research question: Do GAT advertisements under or over represent subjects of certain races in their portrayal of themes surrounding ethnic/cultural identity, family ties, and ancestry?**

The need for a study examining advertisement techniques employed by GAT companies was in part inspired by an Ancestry.ca advertisement, *Inseparable,* which was released and then quickly pulled from circulation. The advertisement shows a historical depiction of an inter-racial couple in Antebellum America fleeing to the North to get "married." In it, a white man attempts to convince "Abigail," a black woman who is presumably a captive slave, to escape to the North with him, asking, "Will you leave with me?" with a ring. The commercial then cuts to a dark screen that reads, "Without you, the story stops

here," and a marriage certificate appears on screen with the narrator saying, "Uncover the lost chapters of your family history with Ancestry" (Lewis, 2019).

This commercial faced public backlash on major social media platforms who questioned whether this woman was the property of the white man and how Ancestry.com could brush over the harsh realities of life for freedmen and women in the North (Wanshel, 2019). There is a stark contrast between the dangers of life for enslaved people in the American South escaping to the North for freedom and the privileges afforded to customers who can search their last name and read about such dangers. Ancestry tells this "love" story, inspired by real events and real people, with a rosy, white-centric lens. This advertisement and responses from angry viewers serve as testimony to the pitfalls of historic oversights made by GAT companies' advertisements. In choosing this research question, our team hopes to better understand what these GAT advertisements are adding to the conversation about race and whether or not they are altering people's understanding of culture and identity.

This research question treats the three major themes we observed in GAT advertisements: cultural and ethnic identities, current family connections, and ancestral connections. While these themes may seem very different, they share the common message of reducing kinship to a purely genetic aspect and conflating genetics with one's racial/ethnic, cultural, social, and family identity.

<u>Materials and Methods</u>

To answer this question, our team created a corpus intended to be representative of the most popular, mainstream GAT advertisements. First, we selected GAT companies based in Anglophone countries that did heritage testing (as opposed to only health testing). We chose to concentrate on heritage-focused companies rather than health-focused companies because there is more of a direct (though potentially flawed) link between health and genetics than there is between heritage and genetics. We chose to focus on Anglophone companies because we understand the nuances of the English language and because many Western countries, for whom English is the dominant language, have similar notions of race, which is a key element of our analysis. Although we encourage analyzing non-Anglophone, and particularly non-Western GAT companies, we restrict our study to Anglophone companies in order to control for the cultural difference.

Because there is a lack of widely available market data on GAT companies which would indicate company financial success, our team decided to choose companies with the highest number of likes on Facebook as of June 3, 2019, using number of Facebook likes as a proxy for company popularity. We found that Ancestry.com, 23andMe and MyHeritageDNA had the highest number of likes out of a pool of six other companies including AfricanAncestry.com, Living DNA, Family Tree DNA, NatGeo Geno Project, which were extracted from a Google search of popular DNA testing companies.

Our compiled advertisement list includes as many video advertisements as we could find for these companies available on YouTube, the GAT company websites, and iSpot.TV which are under or equal to 5 minutes and 30 seconds in length. The 23andMe "Stories of Connection" advertisement series sometimes featured the same subjects and stories as the 23andMe "DNA Family Stories" advertisement series. We consistently chose to analyze the "DNA Family Stories" advertisement version over the "Stories of Connection" version, in these instances, since the former tended to give more contextual information and visual/audio content for analysis--unless the "DNA Family Stories" version were longer than 5 minutes and 30 seconds. In that case, we used the "Stories of Connection" version instead. Using the above criteria, we found and analyzed a total of 90 advertisements.

Thematic Coding

     The exploratory phase of our data collection included an initial, cursory review of the advertisements, which led us to determine underlying themes of Ethnic/Cultural Identity, Current Family and Ancestry. We coded the video advertisements, based on both their visual and audio elements, into these main thematic categories (ethnic/cultural identity, current family, ancestry) and we coded instances of nature, which we had also noticed as a repetitive theme during our exploratory phase. Each video was coded into at least one category, but it was possible for videos to be coded into multiple categories as well. Each code has a set of standardized criteria.

Ethnic/Cultural Identity

     We coded all video advertisements for the presence of visual and audio references to a subject's ethnic/cultural identity. An advertisement was coded for this category if it included visual or audio references to stereotypical artifacts and activities associated with a particular culture; visual portrayals of DNA results (e.g. statistics, pie charts, numbers, maps) when conflated with visual or audio references to one's racial/ethnic identity; oral references to ties to one's race or culture; visual and audio references to travelling to countries based on one's test results; visual and audio references to one's current racial/ethnic identity; visual and audio references to the test results transforming current perceptions of one's racial/ethnic identities; visual and audio references to genetics determining one's racial/ethnic identity, social interactions, and conceptions about race; as well as visual and audio references to the idea of "newness" and "trying new things" in relation to defining one's racial/ethnic identities. We excluded tangible links to specific people from a region one might not have associated themselves with, such as census records or marriage records because such links would fall under the theme 'Ancestry.'

Current Family

     We also coded all advertisements for visual and audio thematic references to current family. Advertisements were coded for this category if they included appearances and interactions with newly discovered living family members, explicit visual and oral references to newly discovered living family members (e.g. speaking explicitly about newly discovered living family members), as well as visual and oral references to genetics determining familial connections and intimacy. We excluded advertisements in which there were visual or oral references to current family members with already established relationships; only references to newly discovered family members were included.

Ancestry

     Advertisements were also coded for visual and audio thematic references to one's ancestry and heritage. The advertisements coded under this category included video reenactments, images, and footage of historical events; visual and oral references to specific events or hypothetical events from a family's past; visual and oral references to relationships to historical figure(s); visual representations of historical artifacts and documents that prove family history; visibly old (black and white, sepia) photographs; visual depictions of family trees; as well as visual and audio references to names and dates from the past. In other words, we considered tangible roots to dead family members or past events as themes of ancestry. Advertisements that were excluded from this category were ones that referenced connections to living relatives or ones that merely offered connections to a larger culture and history.

Nature

We did not separate videos coded with themes of nature into individual categories, but we did code for these themes visually. A video met the criteria for the theme of nature if it included images or videos of outdoor, natural spaces, untouched landscapes and wildlife.

Subject Race

All subjects in the video advertisements were also coded for perceived race on the basis of visual analysis of skin tone, phenotypic characteristics culturally associated with racial categories, oral identification (if they say "I identify as…"), and context clues in the advertisement (geographic, historical visual or audio references, or visual or audio references to cultural artifacts that stereotypically correspond to a certain racial group). A subject's oral self-identification prior to receiving or revealing DNA test results was prioritized over all other noted criteria above. If there was no oral self-identification prior to the subject receiving or revealing their test results, we took all other noted criteria into consideration to categorize the subject. "Races" were coded as White (W), Black (B), Asian (A), Middle Eastern (ME), Latinx (L), Indigenous (I), and Mixed or Meeting Multiple Phenotypic Racial Categories (MMPRC). If there were multiple subjects with multiple races in the advertisement, race was coded as "Multiple Races."

If there was no definitive subject in the advertisement, race was coded as "No Subject."

When a subject is recorded as "White," "Black," "Asian," "Middle Eastern," or "Latinx," we are referencing people who share certain phenotypic characteristics with people who are commonly seen as white, Black, Asian, Middle Eastern, or Latinx respectively, by American society.

Otherwise said, when we say "white" we are referencing people who have certain phenotypic characteristics associated with whiteness in mainstream American society. These phenotypic characteristics include fair/light skin, blonde/red/brown hair, blue/brown/green/hazel eyes, and freckles.

When we say "Black" we are referencing people who have certain phenotypic characteristics associated with blackness in mainstream American society. These phenotypic characteristics include dark skin, black textured hair, braided or dreaded hairstyles, and wider nostrils. Historical references to familial oppression under American slavery and images of tribal Africa within ads also signify blackness according to our criteria.

When we say "Asian" we are referencing people who have certain phenotypic characteristics associated with Asianness in mainstream American society. These phenotypic characteristics include black/straight hair, a range of skin tones from fair/light - medium/brown, and smaller facial features.

When we say "Middle Eastern" we are referencing people who have certain phenotypic characteristics associated with Middle Eastern individuals in mainstream American society. The characteristics include clothing or religious symbols associated with the religion Islam (burka, hijab, niqab, chador), dark brown hair, and tan/olive skin.

Although Latinx is an ethnicity rather than a race, we felt it was important to include. When we say "Latinx" we are referencing people who have certain phenotypic characteristics associated with Latinx individuals in mainstream American society. The characteristics include fair to tan skin and dark hair. More critically, we look for cultural markers such as language and oral self-identification.

When we say "Indigenous," we consider historical references in the advertisements to cultural indigenous experiences and events of historical oppression or the subject of the advertisement self-identifying as Indigenous or Native America. We did not include phenotypic markers in this coding

because of the complicated history that accompanies those who identify as Native American. We do not think we could accurately classify people as Indigenous without ignoring the debates surrounding cultural identification versus genetic identification that are happening now.

We are using the classification "Meeting Multiple Phenotypic Racial Criteria (MMPRC)," for subjects whose race is not immediately identifiable based on the criteria listed above and/or subjects who meet one or more of the above characteristics for multiple categories. In addition, if there was uncertainty as to how to code a subject's race among the team members, they were marked "MMPRC."

Inter-Rater Reliability

Each of the three researchers coded one third of the total advertisements (30/30/30). To establish inter-rater reliability, we ensured that the thematic and racial coding for each advertisement was coded and verified by at least two different coders. All coding and verification discrepancies or disagreements were resolved through group discussions between all three coders.

<u>**Results**</u>
Subject Race Representation

Subject Race Breakdown for All 3 Companies
23andMe, AncestryDNA, and MyHeritage DNA

No Subject 2.2%
L 5.6%
B 10.0%
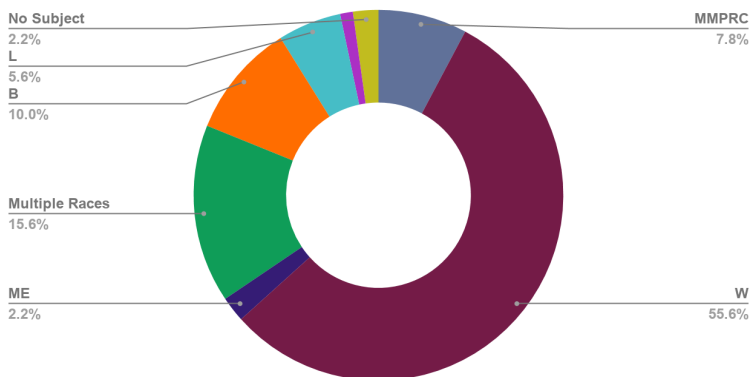Multiple Races 15.6%
ME 2.2%
MMPRC 7.8%
W 55.6%

Fig. 1 | Percentages of Racial Representation in all 90 Advertisements from All 3 Companies

After collecting data on 90 advertisements, we found that the overwhelming majority of subjects represented in all commercials from all three genetic testing companies, are white (see Fig. 1). This trend continues in each of the companies' representations of race. For 23andMe, 2.5% of subjects met multiple phenotypic racial criteria **57.5% were white**, 5% were Middle Eastern, 20% were Black, 5% were Latino, 2.5% were Asian, 7.5% of advertisements featured multiple subjects of multiple races, and 0% were Indigenous. For AncestryDNA, **50% of subjects were white**, 18% met multiple phenotypic racial criteria, 9% were Latino, 3% were Black, 20% of ads featured multiple races, 0% were Asian, 0% were Middle Eastern, and 0% were Indigenous. With MyHeritage DNA**, only white subjects were represented as single or family subjects in their advertisements.** Specifically, 62.5% of all MyHeritage advertisements featured single white individuals or white families, 25% of advertisements featured multiple subjects of multiple races, and 12.5% of advertisements had no subject at all.

Thematic Representation

Figure 2 represents the distribution of the three core thematic elements that we coded for among the advertisements for each testing company. The themes that we coded for were: Ethnic/Cultural Identification, Ancestry and Current Family.
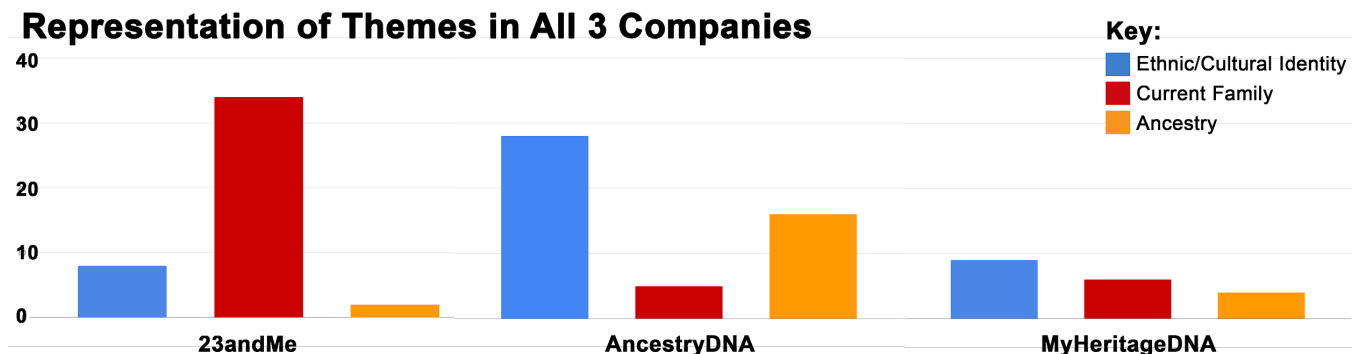

Fig. 2 | Number of Times Each Theme is Represented for all Three GAT Companies

For 23andMe, the majority (77.3%) of their 44 total advertisements included elements characteristic of the "Current Family" thematic category. Advertisements classified under the "Current Family" theme occur 4x more often than those classified under the "Ethnic/Cultural ID" theme. The "Current Family" theme is also 17x more prevalent in 23andMe advertisements than the "Ancestry" theme (see Fig. 2). This trend suggests that 23andMe relies on familial narratives emphasizing familial and genetic kinship to sell their product; they utilize primarily testimonial-style advertisements for all of their "Current Family" advertisements.

For AncestryDNA, the majority (57.1%) of their total 49 advertisements included elements classified under the "Ethnic/Cultural ID" thematic category. There are 1.75x more advertisements coded under the "Ethnic/Cultural ID" theme than those coded under the "Ancestry" theme. The "Ethnic/Cultural ID" theme is also represented 6x more frequently than the "Current Family" theme. This trend suggests that AncestryDNA relies on themes about ethnic/cultural connectedness and kinship and narratives surrounding changing one's racial/ethnic identities to sell their product; they use a fairly even mix of testimonial-style and actors/action-style advertisements to broadcast their message.

47.4% of the MyHeritageDNA advertisements feature elements characteristic of our "Ethnic/Cultural ID" thematic category. This theme is represented 1.5x more than the "Current Family" theme. Advertisements classified under "Ethnic/Cultural ID" are also 1.25x more prevalent than than those classified under the "Ancestry" theme. This trend suggests that MyHeritage also relies on themes surrounding ethnic/cultural connectedness and kinship and narratives about changing one's racial/ethnic identities to sell their product; MyHeritage primarily uses actors/action-style advertisements (which comprise of 87.5% of their advertisements) to convey their message.

Racial Representation Within Thematic Categories
Note: The larger number of advertisements featuring white subjects relative to the number of advertisements featuring subjects of other racial groups made it difficult to find statistically significant trends within individual racial categories other than 'white.' Because of this disparity, we chose to group

all races (excluding the "white," "multiple races," and "no subject" categories) as "Nonwhite" and represent our results in two categories: White vs Nonwhite.
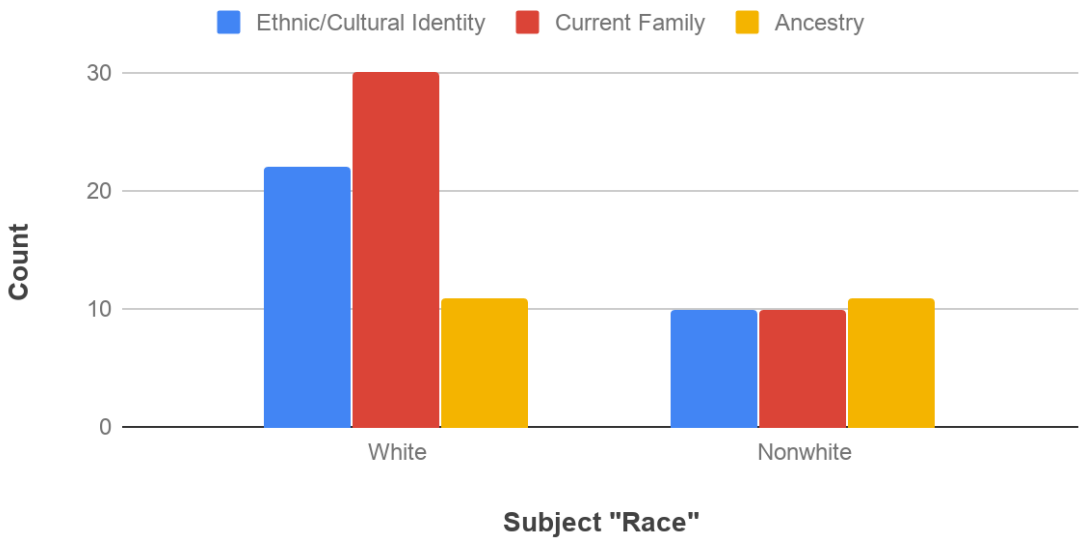

Fig. 3 | Number of Times the Subject of an Advertisement is White vs Nonwhite in all Thematic Categories for all Three GAT Companies

Figure 3 demonstrates the disparity between representation of White and Nonwhite subjects in all three of our classified thematic categories for all three companies. Overall, advertisements classified under the "Ethnic/Cultural ID" thematic category feature white subjects more than twice as often than Nonwhite subjects and advertisements coded under the "Current Family" theme feature white subjects three times as often as Nonwhite subjects. Advertisements classified under the "Ancestry" theme feature an equal number of White subjects as Nonwhite subjects. See Figures 4-6 for the individual company breakdown of subject race per thematic category.

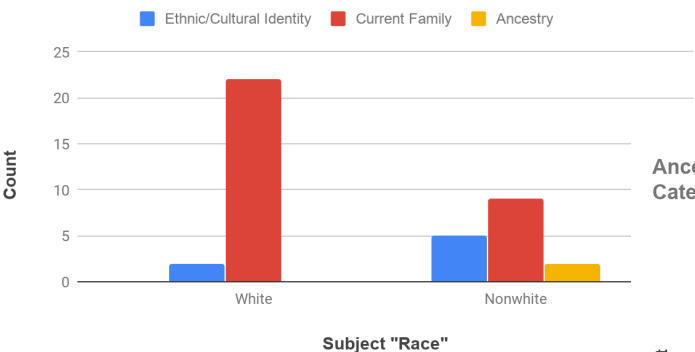Fig 4 | Number of Times the Subject of an Advertisement is White vs Nonwhite in all Thematic Categories for 23andMe
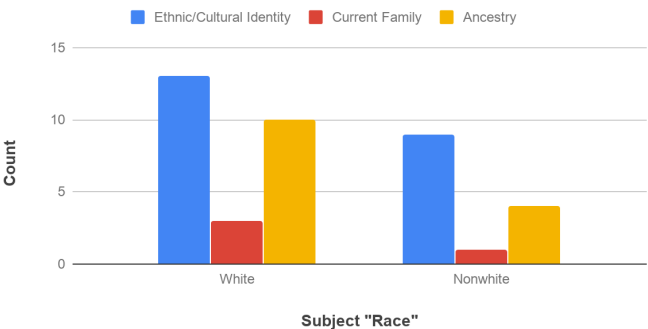

Fig. 5 | Number of Times the Subject of an Advertisement is White vs Nonwhite in all Thematic Categories for AncestryDNA

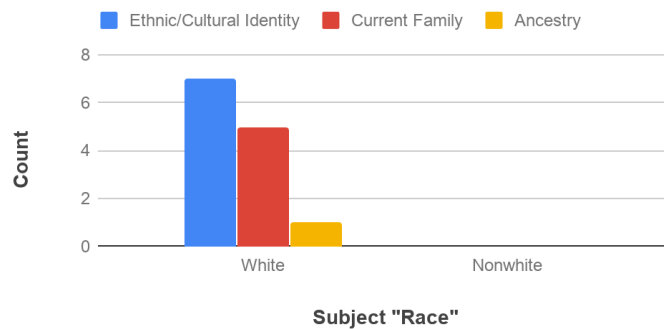**MyHeritage DNA: White vs Nonwhite Representation in All Thematic Categories**

Fig. 6 | Number of Times the Subject of an Advertisement is White vs Nonwhite in all Thematic Categories for MyHeritageDNA

Case Studies

Case Study #1: "The Sum of Us": *This AncestryDNA Canada advertisement portrays the "life-changing" journey of a white couple who immerse themselves in the Indian culture revealed in their DNA tests[1]. It begins with "Sarah" finding out she is 6% South Asian. Her husband Scott says "I already knew about my Indian ancestry, but Sarah's discovery set us on a journey that would change our lives." The camera then pans to shots showing the couple in an Indian grocery store purchasing spices and fruit, cooking presumably Indian food in the kitchen, and separate scenes of them learning an unspecified regional Indian language with a private tutor. In the next scene, the couple excitedly book a flight to Delhi, India, and it cuts to the couple waiting nervously in a room. A young Indian girl is then ushered out by an older Indian woman. Sarah, wearing a sari, kneels in front of the girl and Scott says a phrase that is translated at the bottom of the screen as "It's nice to meet you." The little girl then flashes them a grin. The advertisement ends with the narrator's voice, "DNA can not only create life, it can change one. How will your life change with AncestryDNA?"*

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[1] In these case studies, terms of racial categorization such as "white" or "mixed race" refer merely to the category in which the subject was coded by our research team according to the methodology described earlier in our paper.

Case Study #2: "Kim": *This is an AncestryDNA commercial that features Kim, a MMPRC woman explaining how her test results transformed her ethnic/cultural identity. The advertisement starts with Kim saying "I wanted to know who I am and where I came from." Visually, the advertisement displays a pie chart showing she is 26% Native American, which Kim says was the most "shocking" result. The shot also prominently*

features podiums laden with vases and artifacts. These artifacts have patterns on them typically associated with Native American culture by mainstream American society. It concludes by zooming into these artifacts and with Kim saying, "Just to know this is what I'm made of, this is where my ancestors came from, I absolutely want to know more about my Native American heritage. It's opened up a whole new world for me." The advertisement never specifies what type of Native American ancestry Kim had.
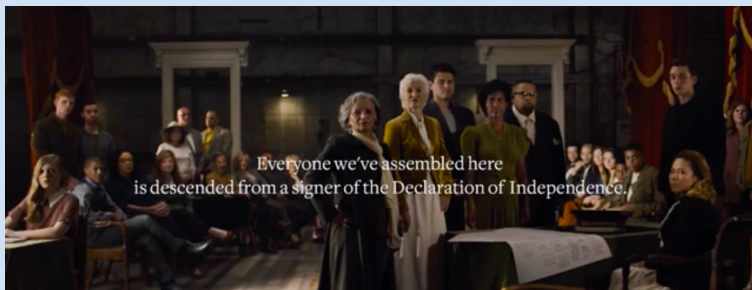

Case Study #3: "Adam and Ben's DNA Family Story": *In this 23andMe advertisement, the viewer is introduced to Adam and Ben, newly father and son. Adam is a 30-something-year-old man who would fit into the category of Meeting Multiple Phenotypic Racial Criteria. He appears on the screen next to his father, a 50-something-year old man who would meet the coding criteria for Latino. The two sit close to each other as Adam explains his original impulse for using 23andMe, that he wanted to discover his ethnic identity, and how surprised he was to find a biological half-brother on the site. Ben then confesses that he didn't even know Adam existed until his son Levi called him to tell him the news. Adam always knew he was adopted and he says "I've had a greater sense of wanting to be connected to a family in a bigger way." The advertisement shows videos of Adam and Ben meeting for the first time and Adam spending time with his new biological family members. Even though the two men have lived most of their lives separately, they both discuss themes of kinship and joy in their reunion. Ben says that Adam fits right in with his family (he has four children from a different relationship). Ben shares that he feels like he has four new siblings now.*

Case Study #4: "Inseparable": *In this Canadian AncestryDNA advertisement, the viewer is taken back in time to what appears to be Antebellum America. The advertisement uses actors to play Abigail, a Black woman, and an unnamed White man. Abigail and the man speak in hushed tones as they appear to be hiding from someone. The man says, "Abigail, we can escape to the north. There's a place we can be together across the border. Will you leave with me?" Abigail appears to be deliberating her options as the screen turns black and text appears that says, "Without you, the story stops here." An image of Abigail Williams' marriage certificate appears on the screen, the year is 1857. The commercial was pulled from usage after people complained that it romanticized a mixed race relationship under slavery.*

Case Study #5: "Declaration Descendants": *This AncestryDNA commercial showcases both genetic and ancestral services. It begins with a slow group reading the iconic first lines of the Declaration of Independence while people of all ages and ethnicities sit down in a dimly lit room and dramatic music plays in the background. The camera then visually depicts the individuals in the room continuing to recite the Declaration. At the end of the commercial, the people assemble in a similar format to the men who signed the Declaration of Independence and text appears saying, "Everyone we've assembled here is descended from a signer of the Declaration of Independence."*

Case Study #6: "Anthem": *This AncestryDNA commercial features an action style, reenacted historical narrative of one unnamed MMPRC woman's history. It begins in Eastern nations, showcasing a rural African village or empire and one scene of people travelling in traditional garments through the desert. It then cuts to Western representations of American technological advancements, and pays homage to 1940s gangster culture. A short clip shows traveling Native Americans, presumably on the Trail of Tears. The camera then shifts to a scene of a boat voyaging the ocean before cutting back to the African scene, zooming on the matriarchal leader's features and the traditional garments of the Africans surrounding her. The advertisement ends with the MMPRC subject looking into the distance and the narrator asks, "If you knew what they did, what would you do?"*

Case Study #7: "Surprisingly Interconnected": *This 23andMe advertisement features several interviews with people of different races, interspersed with fast-moving slideshows of what seems to be stock photos of black and white hands together, diverse groups smiling at a camera, people of different races interacting, portraits of individuals from diverse races, etc. In one of the interviews, "Beth", a white woman, reveals that she found she was "distant cousins" with an African American Stanford professor, "Roy." Then "Monica", a Black woman, said, "I find that fascinating that you can be connected to these people that you would think you have no connection to. But in fact, you're sharing a large portion of your DNA makeup with them." The founder/president of 23andMe, Anne Wojcicki, then appears and says, "If I just look at you, how do I actually know what your background is? You look at me and you might think I am European, but I actually have a tiny bit of Asian." Monica continues saying, "We have these stereotypes and ways that we identify ourselves, but the lines are much more blurred and much more gray than we perceive it to be." Roy says, "In the 21st century, I think we're shifting into a whole new notion of connectedness." The video concludes with Anne saying: "Even though we all may look different, we really are all connected on the genetic basis."*

Case Study #8: "Bring Neighbors Together": *This AncestryDNA Canada advertisement opens by asking viewers, "How can DNA bring neighbors together?" It then presents two neighbors with a fence erected between their houses as their kids each separately play hockey on their respective sides of the fence. The neighbors are tense and awkward in conversation. One*

of them then finds out from an AncestryDNA test that he is 15% Irish; he shows his neighbor, who is also Irish, the result, and they are "instantly connected." The man's wife then brings out hot drinks for them to all share, and then the camera shifts to the two neighbors tearing down the fence together. The man says, "I was never good at making friends out of neighbors. Then I tried AncestryDNA and learned we had more in common than just a fence. Eventually, two yards became one yard, two neighbors became friends." The advertisement ends with them and their kids playing hockey together.

Case Study #9: "Momondo: the DNA Journey":

This AncestryDNA advertisement was created in partnership with Momondo, a travel fare search engine. It opens to emotional and surprised subjects finding out their DNA test results and then pans to the question, "Would you dare to question who you really are?" They were then asked which nationalities in the world they don't like or don't get along with, and each responded with a generalized group of people that they "didn't like" for various explained or unexplained reasons. The subjects were then asked to spit in a tube to take the DNA test. Two weeks later, all the subjects returned and sat in the audience together as they are called up one by one to read aloud their DNA test results. All of them find out that they are not 100% from one region or racial group like they previously believed and are all visibly surprised and emotional at the results, laughing and crying. Some are even from regions that they previously expressed "dislike" towards. Towards the end amongst all the emotional and surprised reactions, the camera focuses on a MMPRC woman subject that says "I'm going to go a bit far right now, but this should be compulsory. There would be no such thing as extremism in the world if people knew their heritage like that, like who would be stupid enough to think of such things like pure race?" Afterwards, a Middle Eastern woman is told she has a cousin in the audience and a tearful reunion takes place in the room. Then text appears on-screen, "You have more in common with the world than you think." The subjects were finally asked if they would like to travel to all of the places in their test results and they all say yes, before text appears: "An open world begins with an open mind."

Case Study #10: "Kyle Traded His Lederhosen for a Kilt":

This AncestryDNA advertisement opens to Kyle describing his strong German roots and upbringing, saying, "Growing up, we were German." The camera pans to him wearing lederhosen and dancing. But after finding out his DNA test results, he found out he was actually "not German at all" and was instead 52% Scottish and Irish. At the end of commercial, Kyle says, "so I traded in my lederhosen for a kilt" and the camera shows him wearing a kilt.

Case Study #11: "Kamal: Transforming His World Through DNA": *This 23andMe advertisement opens to Kamal sitting and watching his son bowl. Kamal explains that he was born in Lebanon and lived in the United States. While his whole family claimed to be Lebanese, he suspected that there had to be "something else" there because his mother had light eyes. Black and white pictures of Kamal and his mother are shown on screen. After taking a 23andMe test, Kamal discovered that he had some Italian ancestry. He said, "I always felt a part of me was Italian, you know I speak with my hands you know, I like Martin Scorsese movies, I like watching the Sopranos, I have an affinity for men's jewelry, none of my other friends do, it explains the Italian very well." The video then shows him chopping and cooking for his kids, conjuring images of Italian chefs and cuisine. Kamal says that taking the DNA test changed the way that he looked at himself and other people. He describes it as an experience that connects everyone, saying "My hope is that through time more people will become aware of what it is they share with other people and it's irrefutable, it's in the genes. I think it will really change the world. I believe that."*

Discussion

This study set out to discover the ways GAT companies under or over represent subjects of certain races in their portrayal of themes surrounding ethnic/cultural identity, family ties, and ancestry in advertisements. Our quantitative results indicate that white subjects are over-represented in all GAT advertisements, particularly in all advertisements that focus on current family and ethnic/cultural identity themes, and AncestryDNA advertisements that focus on ancestry themes. Our qualitative analysis indicates that these companies market a white-centric notion of interconnectivity among people that conflates genetics with identity and cultural/familial kinship, and promotes identity cherry-picking and essentialist ideas surrounding culture and identity. Ethnic/cultural identity-themed advertisements tended to feature certain tropes: the adoption of new cultural patterns and habits assumed to be embedded in one's newfound genetic code and the use of stereotypical cultural objects, symbols, or activities to stand in for full immersion into a new ethnic/cultural identity. Ancestry and current family-themed advertisements tended to romanticize cultures and stories, employing generalizations while disregarding political, historical, and familial contexts. In this section, we use our quantitative coded findings as well as qualitative case studies from the analyzed advertisements to exemplify these emerging themes.

Romanticization & Neglecting Contexts
"Current Family" Advertisements

In total (Fig. 3) as well as individually for all three companies (Figs. 4-6), "Current Family" was a significantly more prevalent theme in advertisements featuring white subjects than in advertisements featuring non-white subjects (48% vs 32% for all 3 companies, 12% vs 8% for AncestryDNA, 92% vs 31% for 23andMe, and 38% vs 0% for MyHeritageDNA). These white-centric "Current Family"

advertisements, featuring white family reunions and genetic kinship narratives, are overrepresented in advertisements from all three GAT companies, especially 23andMe (Figs. 2, 4-6).

Given social stigma surrounding single black mothers and poverty or black families and adoption, one plausible reason why GAT companies' choices to over-represent white families in current family advertisements may be to avoid the popular stigma/stereotype of the "broken black family" (Hymowitz, 2005; George & Levin, 2015). They play into a trope of whiteness not influenced by these stereotypes that may conjure negative, racial images of collapsed families and putting children up for adoption. Primarily using white families as subjects can thus ignore the social, cultural, and economic reasons that motivate individuals to place children in adoption or become disconnected from biological family, allowing the narrative to take a less provocative form. These current family advertisements also tend to generalize and romanticize all family reunion stories into one single type of narrative, painting them all with a similar, white-centric brush while ignoring other potentially complicating contexts of cultural, social, or personal family dynamics. Especially with the

Moreover, this focus, especially on the part of 23andMe, on instant familial connection as a result of genetic connection from DNA test results reduces kinship to solely genetic similarity (Fig. 2) (Marks, 2002). Scholars argue that North American societies in particular already hold a "genetic or 'molecular' family ideal" that focuses on genes as the basis for real family and human bonding (Nelkin & Lindee, 1995). These cultural attitudes, which are only further reinforced by such advertisements, have contributed towards the ongoing stigmatization and negative framing of adoption and less traditional forms of kinship or family (Wegar, 2000). These advertisements also gloss over problematic questions of consent. This is exemplified in 23andMe's advertisement, "Adam and Ben's DNA Family Story," which emphasizes instant, intimate genetic kinship (Case Study #3). Adam even said that he was not looking for his biological family when he joined 23andMe and Ben said he had no idea that he even had a son. Ben's other son (Adam's half-brother) is the one that brought the two men into each other's life. The lack of intent to find family raises the question of whether the men consented to sharing this data and allowing this reunion to happen, and could have been potentially traumatizing and disrupting for both men. These advertisements convey that when one of your family members joins these sites, personal decisions have the potential to be revealed, but you have no say in the matter; if someone in your biological family decides to publicize their DNA on these sites, your information is put out there as well.

"Ancestry" Advertisements

Similarly, for specifically AncestryDNA, the "Ancestry" theme was more represented in advertisements featuring white subjects than in advertisements featuring non-white subjects (38% vs 28%) (Fig. 5). Interestingly, while Latinos and MMPRC individual/family subjects were represented in these "Ancestry" themed advertisements featuring nonwhite subjects, Black individual/family subjects were not. This may reflect the larger desire on the part of GAT companies to focus on rosy, romanticized, unprovocative ancestral stories of glorified accomplishments, journeys, and discoveries already celebrated in mainstream eurocentric narratives and histories, and to ignore slavery as a key aspect of many family histories, both Black and White. On a logistical level, records of Black Americans were not documented until the 1870 Census, so many families - not to mention genetic ancestry testing companies - cannot access complete ancestral records (Berry). This illustrates how GAT

companies' current dearth of DNA data for racial minorities is part of a larger, more historic and intentional erasure of family history and information for racial minority groups.

In fact, the only mention of blackness or black subjects from "Ancestry" themed in AncestryDNA advertisements are in "Declaration Descendants" (Case Study #5), "Anthem" (Case Study #6), and "Inseparable" (Case Study #4). However, even in these advertisements, the black ancestral narrative is placed within a broader scheme of racial reconciliation or white American ancestral narrative. For example, "Inseparable," which was pulled from usage after the public backlash, romanticizes a inter-racial "love story" in the Antebellum South in a time when Black people were still considered property (Wanshel, 2019). The advertisement neglects the history that underlies this rosy "love story," ignoring the power dynamics and questions of rape and sexual assault/coercion at play. "Declaration Descendants" similarly ignores the broader historical context of why African American descendants were in that room in the first place, choosing to instead disproportionately focus on the larger, glorified, white- story of America and its founding fathers.

Cross-category themes: "Interconnectedness" and Cherry-Picking Identities

Ultimately, all three companies use the three themes to emphasize the idea of genetic interconnectedness between people to convey a centralized message of bridging differences and bringing people together, whether that be unknown family members or strangers. The 23andMe advertisement, "Surprisingly Interconnected" subtly promotes ideas of racial "diversity" and "connectedness" with its photo slideshows, and with its testimonials and interviews, explicitly equates genetic similarity with "connection" with other people (Case Study #7). Similarly, AncestryDNA Canada's advertisement "Bring Neighbors Together" clearly communicates that evidence of genetic similarity and kinship between people have the capacity to positively transform our perceptions of our social relationships and relatedness, bridging superficial differences and translating into instant social connections and friendships (Case Study #8). However, the messaging also seems to suggest that social connection and relationships are contingent on genetic similarity, implying that without the proof of genetic similarity, the neighbors wouldn't have become friends. AncestryDNA's "Momondo: The DNA Journey" (Case Study #9) as well as other advertisements like AncestryDNA's "Reactions," and 23andMe's "Discovering Roots" also endorse these ideas. They suggest that DNA tests are necessary in our society in order to show people that they are genetically connected to more countries, cultures, and peoples than they previously thought, therefore supposedly dispelling any justification for racism and/or prejudice.

In deploying these ideas of connectedness and encouraging viewers to focus on the genetic commonalities between people rather than the differences, these advertisements attempt to defeat racism through strategies of racial reconciliation. While the language of the advertisements may be race-conscious, the effect of the advertisements may be to encourage racial "color-blindness," an idea that results in the refusal to acknowledge the effects and reality of racism and white privilege in society (Bonilla-Silva, 2017). Using the idea of genetic similarity to form the basis for human social relationships and how people treat and relate to one another can be potentially dangerous. Just as the idea of genetic similarity and genetic kinship can be utilized to proclaim connection and inclusion, it can also be mobilized to suggest disconnection and exclusion because kinship is inherently classificatory (Franklin & McKinnon, 2000; Brubaker, 2009). According to Nash, 2015,

> [Genetic tests] are as much about making distinctions and differentiating degrees of relatedness
> as they are about making connections and emphasizing commonalities, despite the stated

emphasis on human unity and shared ancestry... Simply put, pursuing this logic implies that genetic similarity through shared ancestry is the natural foundation for solidarity, care, and collective identity, and a sense of social or cultural difference, antipathy, or alienation naturally correlate with genetic dissimilarity.

The advertisements' focus on interconnectedness delineated by genetic similarity and racial classifications may suggest that Nelson's finding of test-takers adopting intentionally selected "geneticized" identities may derive, in part, from representations in GAT ads (Nelson, 2008). Following Nelson, we refer to this practice of selectively adopting "new" cultural identities based on genetic ancestry testing data as "cherry-picking" ethnic identities. Roth and Ivemark's study provides quantitative data for this phenomenon, revealing that 36% of test-takers cherry-pick identities based on their test results (Roth & Ivemark, 2018). Our data indicates that advertisements often positively portray consumers displaying this behavior. For example, in the AncestryDNA commercial, "Kyle Traded His Lederhosen for a Kilt," Kyle immediately adopts a new Scottish identity while rejecting and discarding his previous, deeply-rooted German identity following a DNA test (Case Study #10). The advertisement conflates DNA test results with racial/ethnic identity and cultural connection, encouraging test-takers to pick and choose which geneticized identities they wish to adopt and discard. The phrase, "growing up, we were German" especially reinforces that culture and identity is something that can be easily and flexibly selected.

Our finding that both AncestryDNA and MyHeritageDNA advertisements disproportionately focus on ethnic/cultural identity themes for white subjects (Figs. 5, 6) seems particularly noteworthy given Roth & Ivemark's finding that white test-takers are more likely than non-white test-takers to consider their DNA test results to be meaningful and transformational on their ethnic/cultural identities. White people, who tended to feel their whiteness to be "boring" or "normative," were more likely to embrace a new, more complex, "exotic" multiracial identity than their nonwhite counterparts in reality - in other words, to perform ethnic identity cherry-picking (Roth & Ivemark, 2018). Although we cannot know whether the consumer behavior of white clients influences advertising tactics or vice versa, we found that GAT companies choose to feature white subjects disproportionately when they are marketing their services as ways in which to discover a new, cherry-picked ethnic identity, suggesting that Roth and Ivemark's findings on problematic consumer behavior (ethnic identity cherry-picking) is closely tied to problematic company marketing practices encouraging such behavior.

The qualitative data of our case studies also serves to illustrate how white subjects tend to be represented in advertisements which encourage ethnic identity cherry-picking through the mobilization of stereotypes. For example, in the AncestryDNA Canada advertisement, "The Sum of Us" (Case Study #1), Sarah and her husband embrace their newfound racial and cultural identities through stereotypical cultural objects, symbols, and activities, such as buying and eating Indian food, learning languages, travelling to India, and wearing a traditional Indian sari, implying that their DNA test results provide them with the right to claim Indian culture and identity. This is evidence of cherry-picking, since their results showed other ethnic or geographic origins for their DNA, but they chose to focus on the exotic "Indian" percentage they both shared. Similarly, in the commercial "Kim," AncestryDNA uses stereotypical Native American artifacts (ceramic vases) and symbols to represent the newly transformed identity of Kim, who sought to "know who [she was] and where [she] came from" (Case Study #2). The stereotypical objects portrayed in such advertisements are tools used by these companies to not only

represent Kim's cherry-picked Native American ancestry, but also to conflate genetic data and cultural connection. They suggest that embracing these stereotypes` and merely having a shared percentage of genetic similarity activates a new, "geneticized" ethnic/cultural identity. Now that Kim knows her DNA results, she knows "who [she] is."

However, scholars generally agree upon the complexity of culture - that cultural connection and identity cannot be equated to biogenetic inheritance (Nash, 2015; Abu El-Haj, 2012). Reducing ethnic/cultural identity into a few widely-perceived stereotypes and something easily transformed by GATs hurts people who have identified as part of that culture for their entire life. If all that is needed to lay claim to a culture is proof of some percentage of genetic similarity, then the cultural complexity and social effects of racialization of that group is completely undermined - especially when white-presenting individuals are able to experience these surface-level, stereotypical aspects of a non-white identity without experiencing the oppression of actually having a marginalized identity (Roth & Ivemark, 2018). The general over-representation of white subjects in all coded advertisements lend further support to this idea (Fig. 1).

Towards Essentialism

In conflating genetics, one's kinship/connectedness to others, and one's self-perceived ethnic/cultural identity, these advertisements may encourage viewers to misinterpret genetic testing as reinforcing ethnicity and culture as essential, biological fact, as some scholars have warned (Shriver & Kittles, 2004; Bolnick et al., 2007). In advertisements such as "Kamal: Transforming His World Through DNA," 23andMe conveys the idea that genetic makeup is a critical factor in the development of personal, ethnically-signifying characteristics (Case Study #11). It unscientifically suggests that stereotypically Italian habits and preferences such as speaking with one's hands, liking Martin Scorsese movies and men's jewelry, etc. are determined by one's genetic similarity to a company's Italian reference population, what Kamal, seems to consider his "Italianness." This idea conflates genetics with culture, emphasizing that your genetics determine aspects of your personality that reflect larger aspects of the culture in your results. Additionally, it boils an entire culture down to a few shallow stereotypes, implying that having or adopting such stereotypes can allow one to fully embody a culture. Even the language he uses when he says, "it's irrefutable, it's in the genes" subtly reinforces the idea that culture is genetically determined.

Limitations & Future Directions

Though our study presents a comprehensive overview of the thematic modes used by GAT companies to convey ideas of connectedness, there may be some potential limitations in this study that could warrant future studies. Future studies may benefit from incorporating more detailed methodology parameters beyond the scope of this study. This could include analysis of additional commercials, expanding the number of GAT companies under consideration, and review of non-Anglophone advertisements. This study was limited by lack of access to market share data, which could help guage audience demographics reception to advertisements; future researchers should try to find such data to help them assess their findings. Furthermore, our study only focused on the advertisements and messaging of the companies themselves. Future studies should additionally look into the reception of these advertisements and messages, perhaps through an ethnographic perspective examining the impact that the advertisements and the trends/themes noticed in our study have on the companies' intended

audience. As noted, future studies may benefit from analyzing advertisements from non-Anglophone companies that specialize in GAT for people of color, such as AfricanAncestry.com. This could provide insight on differences in the advertisement techniques used and in the intended audience's perception of these advertisements compared to our study.

Despite these limitations however, our findings importantly set the foundation for future research in this field. This study introduces a new approach and perspective on evaluating the GAT market and its impact on society by analyzing the advertisements and messages it broadcasts to the public.

Conclusion

In trying to promote ideas of kinship and interconnectedness, we found that these advertisements broadcast generalized narratives that over-represent whiteness and frequently ignore the larger cultural and social nuances of life experiences that vary within different identities, families, and throughout history. The portrayal of cultural objects, symbols, and activities in the advertisements convey stereotypes that serve to conflate genetic data with identity and encourage a form of identity cherry-picking that often neglects the oppression of marginalized identities. Generalized and romantic representations of historical events like slavery and Native American genocide and colonization convey a limited understanding of the current effects of these conflicts on modern populations. Their presentation of families reunited after 30 years of separation from adoption and disconnection also demonstrates a manufactured idea of family that caters to whiteness and ignores the deeply complex bonds that exist in every family, biological or otherwise. Through this, they conflate DNA test results with connection to one's own ethnic/cultural identity, as well as other people, countries, and cultures, thereby founding human relationships and identity on genetic similarity and reducing kinship to being purely genetic, as opposed to being fundamentally influenced by the environment and people you're exposed to. In doing so, these companies may also inadvertently imply that family, culture, and race are interwoven in the fabric of our individual humanity.

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