Race as a 'Bundle of Sticks': Designs that Estimate Effects of Seemingly Immutable Characteristics*

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Abstract

Although understanding the role of race, ethnicity, and identity is central to political science, methodological debates persist about whether it is possible to estimate the effect of something "immutable." At the heart of the debate is an older theoretical question: is race best understood under an essentialist or constructivist framework? In contrast to the "immutable characteristics" or essentialist approach, we argue that race should be operationalized as a "bundle of sticks" that can be disaggregated into elements. With elements of race, causal claims may be possible using two designs: (1) studies that measure the effect of exposure to a racial cue and (2) studies that exploit within-group variation to measure the effect of some manipulable element. These designs can reconcile scholarship on race and causation and offer a clear framework for future research.

Key words: Race, causality, research design, statistical methods

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No causation without manipulation.

Holland (1986)

Questions about group identity are fundamental to political science. Studies attempting to estimate effects of race and ethnicity, however, inevitably encounter methodological problems. Could a scientist conduct an experiment in which subjects were randomly assigned to be of different races? The simple answer – clearly not – has led many to warn against estimating the effects of "immutable characteristics" like race or ethnicity (Gelman and Hill 2007; Holland 1986; 2008; Winship and Morgan 1999).

More specifically, scholars have argued that race poses two challenges. First, any kind of treatment should be manipulable by a researcher – for example by varying administration of a vaccine or enrollment in a job training program. Race, however, is commonly understood as an immutable or unchanging characteristic. Second, race is "assigned" before most other variables; that is, people are typically categorized into one race or another from birth onward. Considering effects of race along with factors that follow birth, like educational attainment or class, risks introducing post-treatment bias. Thus, making statements about the causal effect of race or race-based variables has been widely thought to be a misguided enterprise.[1]

[1]Though race is often defined as a biological inheritance and ethnicity as a cultural inheritance, we use the terms "race" and "race and ethnicity" interchangeably. We do this for a number of reasons. First, many groups, such as U.S. Hispanics, are categorized as a racial group in some contexts and as an ethnic group in others. Second, within social science, the term of choice often varies by region and sub-discipline. For example, the term "ethnic minorities" is used by many European social scientists to refer to groups that would be considered racial minorities within the United States. Similarly, many scholars of comparative politics use ethnicity as an umbrella term for categories that are inclusive of race. Third, epigenetics suggests that biological, environmental and cultural influences interact in ways that can make drawing clean lines between biology and culture challenging. Fourth, in many studies, culturally determined traits are used to estimate effects of race. See Chandra (2006) for an overview of the challenges associated with defining and classifying ethnic identity.

Partly in response, some social scientists studying causal effects of race and ethnicity have adopted narrower experimental manipulations, such as varying the "racial soundingness" of a name on a resume, to approximate random assignment of seemingly immutable characteristics (Bertrand and Mullainathan 2004). While these techniques help identify causal effects of something associated with race, they also introduce additional challenges of definition and measurement. Is race an "immutable characteristic" if elements of race can be manipulated? Are traits like "racial soundingness" the same as race? If not, how do those traits map to other aspects of race or to broader racial categories? At the heart of these methodological puzzles is an even older debate as to the nature of race. Is race an "immutable characteristic," as a primordialist or essentialist framework suggests? Or, is a constructivist framework in which race is conceptualized as a complex, socially-constructed identity with many mutable facets a more useful methodological starting point?

In this paper, we address these questions and propose a new framework for addressing the impact of race, ethnicity, and other seemingly immutable characteristics. Building on the work of both constructivist and quantitative scholars, we propose that, in experimental or empirical contexts, race should be understood as a composite variable or "bundle of sticks." Conceptualizing race and ethnicity in constructivist terms allows race to be disaggregated into constitutive elements, some of which can be manipulated experimentally or changed through other types of interventions. This approach resolves the conflict between the potential outcomes framework of causal inference and seemingly immutable characteristics like race, gender and sexual orientation. This approach is also useful for research focused on descriptive, observational or correlational analyses. Thinking about race as having constituent parts can clarify what precisely is being estimated when scholars attempt to understand how race and ethnicity operate in the world. Taken together,

our approach sheds light on the mechanisms at play and illuminates paths for potential policy interventions.

We illustrate this way of thinking about race by delineating two kinds of research designs: (1) studies that measure the effect of exposing an individual or institution to some racial or ethnic signal and (2) studies that attempt to measure the effect of some manipulable element of race that varies within a single group.[2] In short, our approach reconciles race and causation for many types of research and unifies a diverse body of past research into two coherent methods that can be applied to future scholarship.

This article proceeds as follows. First, we review theories of race developed by existing scholarship. We then briefly explain the potential outcomes framework, lay out the key problems involved with making causal inferences within the "immutable characteristics" framework, and show how theorizing and operationalizing race differently can resolve many of these problems. Finally, we tie these threads together into a cohesive framework that highlights two research designs: (1) exposure studies and (2) within-group studies. Throughout, we point to successful social science research in an effort to help clarify how race-based variables can — and cannot — be used by applied researchers working to extract causal inferences from experimental and observational studies.

Theories of Race

How race is defined determines how it can be operationalized in empirical or quantitative research. Two theories of race have dominated prior scholarship: essentialism and constructivism. Essentialism tends to view race in largely biological terms and to categorize populations by regions of ancestry and phenotype. The origins of the essentialist concept of race remain a subject of scholarly debate. Zuberi (2001) argues the concept develops

[2]While we focus on race and ethnicity, much of this analysis and both research designs could also be used to estimate effects of other seemingly immutable characteristics (see, for example, Boker et al. (2011)).

in the fifteenth century as part of European efforts to rationalize slavery and colonialism. Other scholars emphasize the work of eighteenth century naturalists and Enlightenment thinkers who wrestled with how to classify populations from around the world (James 2011). From that work emerged the idea that members of groups shared "'essence(s)' that are inherent, innate, or otherwise fixed" (Morning 2011, 12). Other scholars argue the essentialist view is associated with, "beliefs that a given social category is discrete, uniform, informative, ...natural, immutable, stable, inherent, exclusive, and necessary..." (Haslam, Rothschild, and Ernst (2000); Morning (2011, 12)).

In the late eighteenth century, social Darwinists and eugenicists adopted ideas of race and advocated concepts of racial hierarchy that profoundly influenced how race was understood to work across science, politics, and society at large. In the 19th and 20th century, movements for and against white supremacy, as well as other forms of race-based nationalism, generated many of the inter- and intra-national conflicts that defined those centuries (Du Bois [1903] 2007). Though explicit arguments for racial hierarchy have moved from the mainstream of society to the margins, racial essentialism continues to inform much of how both lay people and scientists understand group differences (Mendelberg 2001; Morning 2011). Further, scholarly debates continue over how race and genetics determine intelligence, health and other major life outcomes (Devlin 1997; Duster 2005; Hernstein and Murray 1994). Additionally, some contemporary genetic research supports the idea that people with similar geographic ancestry also share clusters of common genes that correspond roughly to modern racial categories (Blank, Dabady, and Citro 2004; Kitcher 2007).[3]

The second theory of race emphasizes the weak scientific basis for racial categories and argues that race is best understood as a social construction (Appiah 1986; Omi and Winant 1994; Zuckerman 1990). In contrast to essentialism, the constructivist approach

[3]For a more thorough treatment see James (2011).

holds that distinctions between so called races and the importance ascribed to various genetic or phenotypic traits are the products of social forces. These social forces include a complicated amalgam of cultural, historical, ideological, geographical and legal influences (Holland 2008; Junn and Masuoka 2008; López 1994; Loury 2002; Rutter and Tienda 2005). How societies categorize difference typically reflects social structures that reinforce group-based hierarchy (Omi and Winant 1994; Sidanius and Pratto 2001).

Though most popular conceptions of race tend towards the essentialist, a considerable body of work suggests that a constructivist theory better fits how race actually operates in the world. For example, a 1974 United States federal ad hoc committee on racial and ethnic definitions struggled with how to categorize people of South Asian ancestry who, earlier in the century, were categorized as "Hindus" and "Hindoos" (Hochschild and Powell 2008). The ad hoc committee initially recommended a designation of "White/Caucasian" but then selected the classification of "Asian or Pacific Islanders" (Nobles 2000). Penner and Saperstein (2008) find that in a 19-year survey of 12,686 Americans, twenty percent of the sample changed race either in terms of self-identification or classification by interviewers. Numerous other examples arise in the changing conceptions of what constitutes an interracial marriage or how children of mixed-race unions should be categorized (Kennedy 2012).

While many social scientists assume constructivism has become the standard academic approach, research suggests otherwise. Morning (2011) (Figure 8, 182) surveyed faculty in anthropology and biology departments across a range of public and private universities and found that only among more elite anthropology departments did a majority of the faculty define race as socially constructed. Among biology faculty, race was defined as socially constructed by fewer than 15 percent of the sample from state universities and fewer than 40 percent of the Ivy League faculty. Similarly, Morning (Table 4, 175) found that 65 percent of college students defined race solely as biology. Among the sub-

sample of students who major in biology, 83 percent defined race as biological and zero percent as a social construct. More recently, Hochschild and Sen (Forthcoming) examine scholarly articles produced across different disciplines, finding that those in the hard sciences are more likely to express enthusiasm or optimism for genetics and genomics technology than do social scientists and humanists; one reason, the authors posit, might be that anthropologists and humanists adhere to a broader constructivism world view, which cautions against putting exclusive predictive importance on genetic information.

Turning to political science, most prior scholarship on race and causation has implicitly relied on similar essentialist ideas. Within comparative politics, many studies include dummy variables representing different "racial" or "ethnic" groups; with American politics or public opinion research, many studies include race as a set of dummy variables for analyzing differences among individual respondents. Thus, most research has assumed race to be an "immutable characteristic" inconsistent with the demands of causal inference.[4] Some causal inference scholarship has taken a more constructivist approach but the methodological significance has, to date, remained undeveloped. Holland (2008), for example, defines race as a "socially determined construction with complex biological associations," (3) but does not pursue the methodological implications. In the sections that follow, we build on the concerns about "immutable characteristics" but operationalize race within the constructivist framework and show that estimating effects of race and ethnicity need not be ambiguous nor incompatible with causal inference.

[4]Why essentialist ideas have predominated is unclear. Zuberi and Bonilla-Silva (2008) argue this is, in part, the product of the particular racial and ethnic experiences of those conceptualizing race as an "immutable characteristic."

Causal Inference and Potential Outcomes

Does a vaccine cause people to live longer? Is a worker training program effective in helping people find employment? At its core, a causal inquiry involves unpacking the effect of some treatment on some outcome in which there is (1) a unit of analysis, (2) a manipulable treatment and (3) a specific outcome. (The literature on the potential outcomes framework is voluminous — e.g., Angrist, Imbens, and Rubin (1996); Holland (1986); Splawa-Neyman, Dabrowska, and Speed (1990); Rubin (1974; 2005) — and we attempt only a bare-bones introduction.) The "fundamental" problem of causal inference is, however, that we can never observe the difference between these two potential outcomes for any individual unit (Holland 1986; Rubin 1978). That is, a single unit simply cannot receive both the treatment and the control at the same time. This problem extends to all kinds of inquiries, but it becomes particularly vexing when it comes to seemingly immutable characteristics.

In lieu of trying to estimate an unobservable true treatment effect, those interested making causal inferences usually estimate some version of the *average* treatment effect, which is the difference between the mean outcome in treated and control populations. An obvious problem is, however, that differences in the outcome variable could be due to inherent differences between the treated and control populations, a problem that some refer to as selection bias (Angrist and Pischke 2009). For example, we should not be surprised to see that workers who have signed up for a worker training program are more successful in getting jobs – but we also should not be surprised that they are also more ambitious and better educated than non-trained workers.

The problem is solved in some circumstances by comparing only similarly situated treated and control units. To get at a satisfactory estimate of the average treatment effect, we would like our treatment and control groups to be similar across all background vari-

ables that could affect both the probability of receiving treatment or the eventual outcome such that the only difference between the two groups is that one received the treatment and the other did not. Many empirical efforts are geared toward trying to satisfying this ignorability requirement – that is, to make the treated and control populations as similar as possible so that the treatment regime could be assumed to be random. By far the easiest way to satisfy the ignorability assumption is simply to assign the treatment randomly such as in a randomized experiment (for a more general discussion, see Holland (1986) or Imai, King, and Stuart (2008)). However, because randomization is rarely an option for many political scientists, and especially elusive for those studying race or ethnicity, researchers have turned to a variety of methods, like instrumental variables or controlling for observed variables, to satisfy the ignorability assumption and infer causal effects with observational data (Dehejia and Wahba 2002; Sekhon 2009).

Challenges of Causal Inference with Race

The existing literature has identified two key problems within the context of race and potential outcomes: (1) race is resistant to manipulation and (2) because race is generally understood to be "assigned" at conception, the host of characteristics for which most social scientists control (e.g., education, income, etc.) occur after the treatment is assigned and therefore have the potential to introduce post-treatment bias (Greiner and Rubin 2010). In addition, we introduce a third problem: race is unstable. By this we mean both that, across groups and time, the boundaries defining racial and ethnic categories are in flux and that, within groups, there is substantial variation. Among other issues, this complexity may violate the requirement that a treatment should be comparable across observations.

Problem 1: Race Cannot be Manipulated. Making causal inferences usually demands a neatly defined, manipulable treatment variable. Holland (1986), for example, famously admonishes "No causation without manipulation" to bring attention to the idea that all pertinent potential outcomes must be defined in principle in order to make causal estimates possible in practice. Further, to define all potential outcomes, one must be able to conceptualize an experimental analogy that would lead to the possible outcomes. In other words, as Holland (1986, 954) puts it, "causes are only those things that could, in principle, be treatments in experiments." This idea of a manipulable treatment is echoed by others like Cook and Campbell (1979, 36), who argue that "[c]ausation implies that by varying one factor I can make another vary"; Pearl (2000), who discusses at length the importance of an intervention in estimating causal treatments; and Gelman and Hill (2007, 186), who warn that "a causal effect needs to be defined with respect to a cause, or an intervention, on a particular set of experimental units."[5]

Thinking about race via an essentialist framework, however, means that race is resistant to manipulation or intervention, making it difficult to imagine appropriate counterfactuals. (Imbens and Rubin (2010) refer to race and gender as "currently" immutable characteristics, thereby making the point that future scientific innovations may dramatically ease the effort required to change to seemingly fixed aspects of race.) We can imagine how someone lives as an African American; much more difficult is imagining what experiment or intervention one would design to manipulate the person's race (and *only the person's race*) to check its effect on some outcome. Thus, randomization is not only beyond the reach of many scholars focusing on race or ethnicity, but even conceptualizing what an ideal experiment or policy intervention would look like is extremely difficult. As

[5]While a rich and varied literature (scholarly as well as popular) has developed around how multiracial people self-identify, these experiences represent a third kind of "treatment" – a mixed-race or racially ambiguous treatment (Gates 1997; Halsell 1969; Hochschild and Weaver 2010; Kim and Lee 2001; Faulkner [1932] 1990; Griffin [1962] 1996; Schuyler [1931] 1971).

noted by Holland (1986, 946): "For causal inference, it is critical that each unit be potentially exposable to any of the causes. As an example, the schooling a student receives can be a cause, in our sense, of the student's performance on a test, whereas the student's race or gender cannot." Ultimately, as Angrist and Pischke (2009) point out, research questions for which there are no experimental analogies (even hypothetical ones, in a world with unlimited time, research budgets, and mildly omniscient powers) are fundamentally unidentified questions.

Problem 2: With Race, Everything is Post-Treatment. A second problem with conceptualizing well-defined potential outcomes is that a person's race, as understood according to the "immutable characteristics" approach, is "assigned" at conception or birth. Thus, the host of background covariates that social scientists usually control for or match on (e.g., education, income, age) are determined *after* a person's race is assigned. Taking into account things that happen after the treatment happens or is administered has the potential of introducing post-treatment bias, a pervasive problem within observational social science research (King, Keohane, and Verba 1994; Rosenbaum 2002).

To use a common example, suppose that we are interested in the causal effect of smoking on death and have a population of randomly assigned smokers and randomly assigned non-smokers. Should we control for lung cancer in the final analysis? Probably not: lung cancer is not only highly predictive of death, but it is also a direct consequence of smoking – probably *the* key consequence. If we controlled for lung cancer, the effect of smoking on death would essentially be nil, biased downward by the fact that we have controlled for its primary consequence. Race is obviously different from smoking, but the post-treatment issue applies with equal or greater force: race deeply affects how a person is raised and educated, what kinds of employment opportunities he or she will have, and what kind of cultural and social attitudes he or she will bring to the table. Race, in other

words, affects nearly every kind of socio-economic variable typically included in standard regression analyses, including ones aiming to detect mediating patterns. Including any of these attributes could affect estimates of the causal effect of "race," and not necessarily in a purely conservative direction. Thus, the existing practice of interpreting the residual impact of race is at best poorly conceptualized and at worst introducing serious bias.

Although perhaps unsatisfactory to many applied researchers, the most appropriate initial approach is to drop any post-treatment variables from an analysis (King 1991; King, Keohane, and Verba 1994; King and Zeng 2006; Gelman and Hill 2007). In this context, any factor, attribute, personality trait, or personal or professional experience that could potentially be a consequence of race should be dropped – a practice that would eliminate most of the variables included as standard controls by social scientists. For example, if we were studying the effect of race on employment, we would not control for anything directly impacted by the subject's race, e.g., age, education level, income, criminal record, zip code, health status, etc. The right-hand side of a regression would simply include race and, possibly, sex.[6] We note that this strategy implies that the researcher is interested in the *total* effect of race – which might not be satisfying to researchers or those unfamiliar with the causal literature (VanderWeele and Hernán 2012). However, there may be instances where this is not the case and the researcher is interested in the effects of constitutive components of race; we discuss this below. This kind of research design still also fails to address the critique above that experimental analogies are undefined.

Even aside from the post-treatment issue, we note two further problems with controlling for race-related covariates: (1) common support problems and (2) problems with

[6]Sex, which is also assigned at conception, is one of the few standard control variables that could be construed as being pre-treatment or, at the very least, assigned concurrently with the treatment. We note, however, that some evidence suggests sex ratios can vary by latitude, religion, ethnicity, and other factors collinear with race (Guttentag and Secord 1983; Navara 2009). Other possibly pre-treatment factors (e.g., genotype) are discussed in VanderWeele and Hernán (2012).

multicollinearity. The common support problem arises when researchers include attributes that vary according to race (e.g., welfare status, participation in programs like Head Start, diseases such Tay Sachs or sickle cell anemia). Because these traits are highly clustered within certain groups, it becomes difficult to find cross-race comparisons. For example, finding a sizable group of whites who have sickle cell anemia would be challenging (Thomas and Zarda 2010). Collinearity becomes a problem when variables or effects vary so closely with race as to result in (the most extreme case) unconverged calculations of point estimates. The lack of variance in the background variables may also result in small changes having a large impact on the coefficient estimates – thus, standard errors may be large and lead researchers to assume no treatment effects when treatment effects do in fact exist.

Problem 3: Race is Unstable. Building on the work of constructivists, we propose a third issue that is largely unaddressed by methodologists: race is unstable and can vary significantly across treatments, observations, and time (Lee 2008; Abdelal et al. 2009). The category "Latino," for example, includes first generation Mexican Americans from Los Angeles and fourth-generation Puerto Rican Americans from the Bronx. In one analysis of census data, between the 2000 and 2010 nearly 10 million respondents changed their self-identified race and/or Hispanic origin (Liebler et al. 2014). In quantitative terms, "no two measures of race will capture the same information" (Saperstein 2006, 57). This is true both across different studies and within the same study. For example, Bertrand and Mullainathan (2004) report that the treatment of receiving the name "Ebony" on a resume produced significantly different outcomes from that of "Aisha" even though both are ostensibly the same treatment of a distinctively black name.

The dynamic and variable nature of race and ethnicity extends well beyond names. Bertrand and Mullainathan (2004) mention that they considered "other potential manip-

ulations of race, such as affiliation with a minority group," but opted against out of a concern that "such affiliations might convey more than race" (995, Footnote 17). In other studies, subtle changes in cues like survey wording or clothing in images resulted in significant differences in how race or ethnicity operated as treatments (Sniderman and Piazza 1993; Freeman et al. 2011). Research that fails to recognize this variability may violate the stable unit treatment value assumption (SUTVA) which requires that the treatment status of any unit does not interfere with the outcomes of other units and that the treatment "dosage" is comparable across all units. Quite simply, forcing something as complicated as race into simple binary or categorical variables potentially complicates what we mean by a "treatment." This is a problem not just for research designs focused on causal inference, but also within research designs focused on non-causal inquiries.

Resolving Problems with Race as a "Bundle of Sticks"

Although the problems of causal inference with race can never be fully solved, in some instances they can be circumvented by theorizing race differently and using an appropriate research design. With regards to theory, we encourage empirical scholars to move away from defining race through an essentialist frame and to move toward a constructivist one. For many questions, this shift is not only a better fit for the data but can also resolve problems of instability, manipulability, and post-treatment bias.

The problem of race as a potentially unstable treatment can be addressed, in part, by exploiting the constructivist observation that race is rarely if ever a single, uniform entity. As scholars in race and ethnic politics, sociology, anthropology, and critical race theory have emphasized repeatedly, racial categories are the product of a complex fusion of factors including societal values, skin color, cultural traits, physical attributes, diet, region of ancestry, institutional power relationships, and education. In other words, race

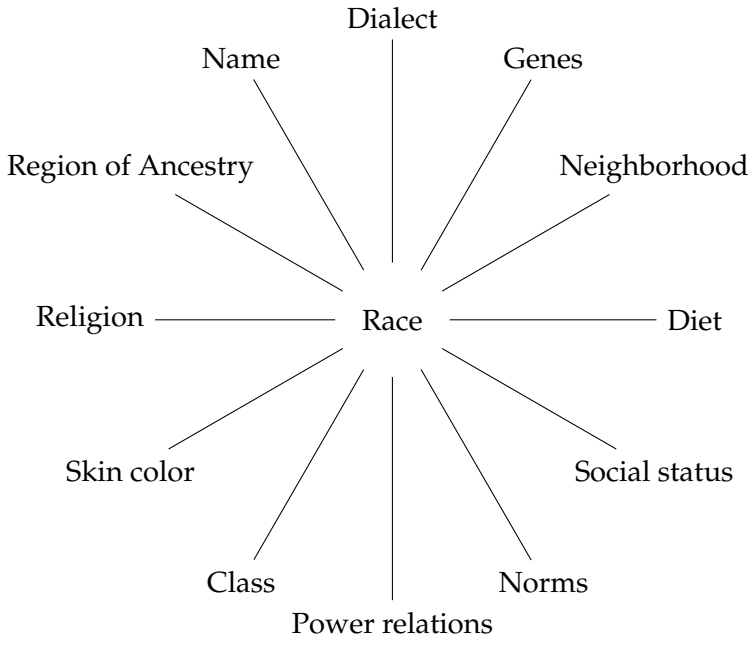

Figure 1: Some characteristics associated with race and ethnicity.

is an aggregate of many component pieces; metaphorically, it is a "bundle of sticks" (illustrated in Figure 1). In contrast to the "immutable characteristics" approach, we argue that race is most accurately understood as a composite measure that can, in some cases, be disaggregated into constitutive elements. Elements of race that are strongly identified with or highly collinear with the particular racial or ethnic category can be thought of as constitutive or what make the composite of race and ethnicity meaningful in the world.

This is not only a much more tractable enterprise but also has the advantage of solving one of the most persistent problems associated with studying race or ethnicity: the difficulty of knowing what exactly is being estimated. A randomized medical trial, for example, that incorporated multiple changes in a diet (e.g., the Mediterranean diet) would be unable to distinguish which elements of the dietary intervention were therapeutic. Only by isolating a single change, say supplementing Omega-3 fatty acids, could a specific effect be isolated. Most causal (or even most descriptive) estimands fail to capture the

entire "bundle" of attributes that constitute "race" and instead capture some constitutive component of race.

To help clarify this approach, we analogize to another commonly used composite variable, socioeconomic status. Socioeconomic status (SES) is comprised of measures like family income, educational attainment, and occupation. Given its composite nature, experimentally manipulating all the elements of SES simultaneously would be difficult. Likewise, it would be problematic to make causal claims with any design that compared people with sharply different SES. We could, however, assess the causal effects of manipulating one element of SES, such as education, within a population of similarly situated subjects. By definition, measures of educational attainment and SES are distinct; but, also by definition, any change to the former will have a downstream effect on the latter. Hence, understanding an effect of education, all else held constant, will help explain an important part of the effect of SES. Similarly, once race is operationalized as a composite variable, estimating the effect of a substantive and constitutive element of race helps explain an important part of how race works.[7]

Once race is operationalized as a disaggregable composite variable rather than a monolithic, homogenous entity, the problem of manipulability can be resolved by identifying an element of race that is both relevant to the research question at hand and that can be manipulated in at least one of two ways. First, many seemingly "immutable characteristics," once disaggregated, are manipulable in the context of experiments. In audit studies, for example, researchers can send confederates into the field to apply for employment and randomly assign the job applicants to be from different racial categories. Similarly in lab

[7]One important difference between SES and race is that the former tends to be coded as a continuous variable and the latter as a discrete variable. As such, manipulations of elements of race may produce "lumpier" effects in things like racial categorization. Even within a discrete coding of race, however, it may be possible to use continuous measures of factors like degrees of identification with a group (see, for example, Knowles and Peng 2005).

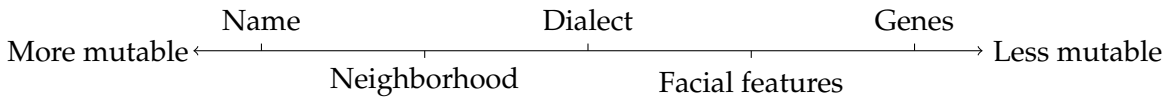

Figure 2: Hypothetical mutability of characteristics associated with race and ethnicity.

and field experiments, researchers can manipulate media with auditory or visual cues about otherwise hard to modify elements of race.

Second, many elements of race are, in fact, mutable. Consider Figure 2, which presents a hypothetical continuum of features associated with race but that exhibit varying degrees of mutability. Facial features – such as the shape of one's eyes or the contours of one's nose – are fairly immutable, possibly changed through plastic surgery but certainly not something researchers could easily manipulate in course of a study or policy intervention.[8] In many experimental contexts, these sorts of traits are less useful as they present the same conundrums identified by the "immutable characteristics" framework. However, traits that are highly collinear with race and mutable are often well suited to causal inference. They are also more likely to be the product of social and environmental forces. For example, a large literature in gender studies distinguishes between "sex" and "gender," where "sex" is defined as biological and anatomical while "gender" is defined as the product of psychological, social, institutional, and cultural forces (see, for example, Deaux 1985; Htun 2005; West and Zimmerman 1987). Similarly, where appropriate, we suggest scholars of race and ethnicity consider distinguishing between less mutable, typically-biologically ascribed correlates of race and more mutable, typically socially or environmentally assigned aspects of race (with the understanding that such categories can never be cleanly delineated). Environmental interactions are also important to consider as many seemingly immutable biologically inherited characteristics, like skin color

[8]The boom in ethnic-oriented plastic surgery might present some interesting, if far-flung, experimental possibilities (Dolnick 2011; O'Connor 2014).

or Alcohol Flush Reaction, are responsive to triggers such as sun exposure or drinking wine.

Finally, the problem of post-treatment bias can be resolved in cases where constitutive elements of race are "assigned" after conception or remain manipulable after conception. Newborn infants, for example, exhibit no preference for faces from their own racial or ethnic groups but three-month-old infants do demonstrate such ingroup preferences (Kelly et al. 2005). Bar-Haim et al. (2006) find that this early encoding of own-group visual preferences can be attenuated by exposure to individuals from another race. Similarly, birth weight can vary significantly by race but evidence from twin studies and other natural experiments suggests that a variety of manipulable factors, like access to food stamps, can positively influence intrauterine nutrition, birth weight, neonatal mortality, adult schooling attainment, height, and, for lower-birth weight babies, labor market payoffs (Almond, Hoynes, and Schanzenbach 2011; Behrman and Rosenzweig 2004; Conley and Strully 2012). Research in life course epidemiology and epigenetics further suggests that many constitutive elements of race are "assigned" by social and environmental forces after conception or birth. Factors like maternal stress, early life undernutrition and other early life forces become "embodied" and durable points of differentiation across adult populations defined by racial and ethnic categories (Ben-Shlomo and Kuh 2002; Kuzawa and Sweet 2009).

A variety of adult life experiences can also shape racial identification and categorization. Living in the suburbs, receiving welfare or being incarcerated can influence how people self-categorize by race and are perceived racially (Penner and Saperstein 2008; Saperstein and Penner 2010). How people die also influences racial classification on death certificates (Noymer, Penner, and Saperstein 2011). Noymer, Penner, and Saperstein (2011) find that victims of homicide are more likely to be classified as black and people who die of cirrhosis of the liver are more likely to be classified as American In-

dian, even when controlling for a separate racial classification offered by the decedents' next of kin. Traits like language and dialect are also highly collinear with racial and ethnic background but are mutable and assigned post-conception. Purnell, Idsardi, and Baugh (1999) make telephone calls to landlords and find significant "linguistic profiling" and racial discrimination against potential tenants on the basis of dialect.

In short, when operationalized as a composite variable, race is disaggregable, some "sticks" are manipulable and the whole bundle is not automatically assigned at conception. In addition, the more mutable characteristics represent attributes that could serve as plausible interventions, including potential policy interventions; that is, we cannot conceptualize how policy actors would intervene in terms of assigning people to one race or another under an essentialist framework, but we can certainly think about meaningful plausible policy prescriptions whereby subjects from different racial or ethnic backgrounds are assigned different names, neighborhoods, income transfers, or diets. Not only does our approach enable these important inquiries, but it does so without running afoul of the potential outcomes framework. Table 1 summarizes how race is operationalized within both the "immutable characteristics" and the "bundle of sticks" frameworks.

Research Designs with Elements of Race

In addition to rethinking how race is operationalized, we encourage scholars to consider whether the question being investigated can be addressed by one of two research designs. In the first design, an element of race operates as a cue or signal that generates some sort of reaction. In the second design, an element of race exhibits within-group variation and explains a part of how the larger composite of race shapes life outcomes. We call the first type an *exposure design* and the second a *within-group design*. Exposure studies are ideal for studying discrimination or implicit bias, as an element of race typically acts as

	Operationalization of Race	
	"Immutable characteristics"	"Bundle of sticks"
Underlying theory	Essentialist	Constructivist
Race manipulable?	No, race an "immutable characteristic"	Yes, race contains mutable and manipulable elements
Always post-treatment bias?	Yes, race assigned at conception	No, some constitutive elements of race assigned after conception
Race unstable?	No, race is homogenous and measurable	Yes, race a "bundle of sticks" that demands disaggregation
Measurement?	Race is typically coded as a binary or categorical variable	Race is a composite variable in which an element of race is the key variable and determines coding

Table 1: Summary of the "Immutable Characteristics" vs. "Bundle of sticks" approach to operationalizing race.

a *proxy* when attempting to estimate an effect of the larger bundle of race. For example, names often act as a proxy to signal many additional traits associated with racial or ethnic groups. For the within-group designs, an element of race is identified to estimate the effect of one *part* or "stick" in the larger whole. As an example, we might study the role of birth weight as a part of racially disparate academic achievement. Both approaches also suggest more meaningful and tractable policy interventions than, say, attempting to understand the effect of race as a whole.

Research Design 1: Exposure Designs

Exposure to racial cue or signal studies convey information about race to a subject. These sorts of studies have been described by Greiner and Rubin (2010) as those that look at the effects of "perceived race" and by VanderWeele and Hernán (2012) as those that look

at discrimination. We use different terminology and draw different analogies, but the research designs we suggest here are comparable. We move away from the "perceived race" and discrimination language for three reasons. First, we think the best way to think about the "treatment" in these kinds of studies is not as perception but, instead as a signal about race. After all, in an experimental context, the researcher can manipulate the signal to which the subject is exposed but not what the subject actually perceives. Second, perceived race is rarely observed. What a subject perceives typically occurs within the confines of a mind and is generally opaque to researchers.[9] As such, focusing on exposure to a racial signal rather than perception of race is preferable. Finally, not all studies involving exposure to a racial cue involve discrimination as conventionally understood. Studies of "stereotype threat," for example, have exposed female and minority students to racial and gender cues prior to taking an exam (Steele 1997). Rather than triggering discrimination by some external source, the cues trigger internal anxiety about confirming negative stereotypes.[10] As such, we prefer to categorize this design by the method of treatment and to be agnostic about the particular context or outcomes of the intervention.

In this type of research design, (1) one or more elements of race is identified as a relevant cue; (2) subjects are treated by exposure to the racial cue; (3) the unit of analysis is the individual or institution being exposed; all three steps alleviate the problems of race and causality. Thus, the research design begins with well-defined potential outcomes, is operationalized via a clean experiment (or a clean experimental analogy), and has a precise moment of treatment. Though a proxy for race as a whole, the causal impact of

[9]With many experiments researchers can pre-test treatments and/or run post-treatment manipulation checks but, even then, much of what subjects perceive remains unobserved.

[10]Some scholars suggest that what we describe as an effect of "race" is more accurately called an effect of "racism" (Kramer 2014). Stereotype threat, for example, may not involve an obvious third party actor but likely operates as a result of widespread efforts to stratify society along racial and/or gender lines (we describe this, later, as a joint effect of the cue and the context in which the cue is received). Should scholars prefer to describe these phenomena as effects of racism, the basic framework we outline remains the same. We only caution that, again, in experiments (or observational studies analogizing to experimental designs) the researcher might measure discrimination but typically does not manipulate racism itself.

race and ethnicity is identified, alleviating the problems of manipulability, instability, and post-treatment bias.

Experimental Exposure Studies. Studies across the social sciences have used some sort of exposure to a racial or ethnic signal as a key feature of the experimental design. In sociology and economics, audit and correspondence studies have been used to measure racial and other forms of discrimination, typically in field experiments. Although the exact methodology may vary, audit studies usually involve confederates or actors hired by researchers who are then randomly sent out to the field. Pager (2003), for example, sent men to apply for working-class jobs and randomly assigned the applicants by race and other attributes. Partly in response to critiques about potential bias introduced by the confederates, correspondence studies, in which matched human applicants were replaced with matched pairs of "paper" applicants, have become more common (Heckman and Siegelman 1993; Heckman 1998).[11] In political science, Butler and Broockman (2011) and Broockman (2013) used distinctively black and white names to craft putative "constituent" emails to legislators.

In sociology and political science, survey experiments with racial signals are now regularly used to estimate effects of race. These experiments typically manipulate survey questions or media, such newspaper reports or political campaign ads, to estimate how randomly assigned racial cues influence attitudes and behavior. Sniderman and Piazza (1993), for example, leverage question order to find that the "mere mention" of race-based affirmative action to white survey respondents provokes more negative feelings towards blacks. A robust public opinion literature exploits some variant of the exposure to a racial signal design to estimate causal effects of race (Gilens 1996; Huber and Lapinski 2006; Miller and Krosnick 2000; Tesler 2012; White 2007). Mendelberg (2001) and Gilliam and

[11] Pager (2007) provides a good overview of the literature, critiques and methods.

Iyengar (2000), for example, create simulated television news experiments to assess how racial cues might prime racial attitudes among white voters. Similarly, Valentino, Hutchings, and White (2002) test whether subtle racial cues in campaign advertisements prime racial attitudes and candidate preference. Bobo and Johnson (2004) use framing experiments in survey questions about criminal justice to estimate how different racial cues shape the "taste for punishment." Gay and Hochschild (2010) conduct a survey experiment to assess the breadth of feelings of "linked fate" by varying racial, gender and other identity cues in question content and ordering (Dawson 1994).

A growing body of research in political science also uses racial cues to evaluate their effects on voting behavior. Green (2004), working with the NAACP National Voter Fund, evaluates whether phone calls from other African Americans and direct mail crafted to appeal to the concerns of African Americans increased voter turnout. Enos (2011) tests a subtle form of racial threat by mailing voters information about proximate outgroup voting rates. Valenzuela and Michelson (2013) conduct a get-out-the-vote experiment in which Latino-surnamed voters receive calls that cue either ethnic or national group identities. Language also matters for political mobilization (Bedolla and Michelson 2012). Abrajano and Panagopoulos (2011) find significant effects of English- vs. Spanish-language appeals in a get-out-the-vote campaign targeting Latinos.

Studies in psychology, and related fields such as political psychology and behavioral economics, suggest additional types of exposure to a racial signal studies. Steele (1997) identifies how internalized stereotypes affect women and racial minorities. Greenwald, McGhee, and Schwartz (1998) develop the Implicit Association Test (IAT) to measure response latencies when subjects are given the assignment to quickly categorize stimuli, often words and images with racial cues, into pairs of categories. Kurzban, Tooby, and Cosmides (2001) expose subjects to images of a hypothetical cross-race conversation and use errors in recall to assess if and how race is encoded in memory.

Although these studies are able to cleanly identify effects, we note several possible sources of confusion as to what exactly is being identified. Broadly, racial and ethnic cues can only generate meaningful effects when they trigger thoughts that subjects associate with a particular group in a particular context. Consequently, racial signals should always be understood to operate as a joint effect of the cue and the social, political and historical context in which the experiment occurs. Failure to distinguish between the cue, the context, and the joint effect can lead to at least three issues.

First, studies may overstate claims about identifying the causal impact of race when, in fact, only an element of race has been experimentally manipulated. In these cases, scholars should be clearer about which constitutive component of race or ethnicity is serving as the treatment. In addition, to make claims about a broader effect of race, scholars should state their assumptions about the link between the element of race or ethnicity being studied and the identity category as a whole (e.g., dialect serves as a proxy for race as a whole). Where possible, researchers should also pre-test the link between the cue and how subjects interpret the signal in terms of identity. Conversely, some studies are careful to only report the effect in terms of an element of race (e.g., "racial soundingness of a name") and fail to convey that the narrow cue likely exhibits powerful effects by triggering associations with race as a whole. Here, precision in describing the treatment can lead scholars to understate or even overlook the fact that the race cue only works as a joint effect with other associations.

Finally, even when a seemingly narrow element of race has been employed to identify broader effects of race, the cue may still encode other information or "sticks" that confound straightforward interpretation. This problem can arise when conceiving of racial categories as coherent, homogenous entities. As noted earlier, Bertrand and Mullainathan (2004)'s pathbreaking study shows that resumes with the first name "Ebony" receive calls by potential employers 9.6 percent of the time while resumes with "Aisha" have a call-

back rate of 2.2 percent. The authors acknowledge "significant variation in callback rates by name" for African American females (1008-1009), but the possible heterogeneity in the "black" treatment remains unexplained within a binary or categorical model of race. While Bertrand and Mullainathan did pre-test the names as racial cues, their results suggest the pre-test did not capture the full range of information conveyed by seemingly similar "black" names. As we emphasize below, these issues can often be resolved through greater attention to what specifically constitutes the treatment and which component of race is being captured.

Although scholars have long viewed audit and correspondence studies as related, we argue that *all* studies employing exposure to a racial or ethnic signal should be viewed as being part of a common experimental design. These studies exploit different techniques – from simulated avatars to scenarios in surveys – the general approach is the same: randomly present a subject with information that differs only with respect to signals or cues about race or ethnicity. It is important to note that the treatment is never all traits associated with race (i.e., the whole "bundle of sticks") but rather only an element of race that serves as a proxy for the larger bundle. Moreover, the meaning ascribed by subjects to the larger bundle depends heavily on combined effect of the cue and the context in which the cue is observed.

Observational Exposure Studies. It is possible to import this research design to a wide variety of *observational* contexts involving how third parties react once they are exposed to racial signals and cues. Greiner and Rubin (2010), for example, investigates how juries react to Hispanic versus non-Hispanic death penalty defendants and Wasow (2012) explores how white voters respond to exposure to protests by blacks that escalate to violence. In these instances, the interest lies in understanding how exposure to a racial signal changes or informs opinions, behaviors, or attitudes. Researchers working with observa-

tional data can structure their analyses to approximate an experimental exposure design. This type of research design is often ideal for testing implicit bias or racial discrimination (Greiner and Rubin 2010; VanderWeele and Hernán 2012).

With observational data, researchers inferring causal effects must be aware of two attendant issues. First, using observational data means that researchers lack the ability to manipulate the racial cues and signals received by the subject. It is therefore necessary to use techniques such as matching or inclusion of control variables in a regression model such that the only observed difference between the treated and control groups is that they are exposed to distinct racial signals (including the possibility that one group receives no racial cue at all). We note that this means that these sorts of research designs still must confront the possibility of unmeasured confounders – e.g., those factors that could correlate with race or ethnicity (and that could affect the outcome) that are not captured by the set of covariates included in an analysis.

In theory, if all confounders are accounted for in a model, a reasonable assumption would be that the residual impact of race is the "causal effect" of race; that is, the effect of race not captured by the other covariates. In practice, this condition is never met and we caution against interpreting the residual in this manner. Generally, it is impossible to know whether all unobserved variables have been included in a model. Moreover, once race is operationalized as a composite variable, what is commonly described as the residual effect of race or ethnicity should be understood as an estimate of the composite effect of all the unobserved elements of race (including possible interactions of any observed and/or unobserved terms).

For example, imagine a simple scenario in which a composite measure of race can be generated using the variables in Figure 1. A regression model that included half of the variables as controls and a term for "race" would be estimating the joint effect of the other half of the terms from Figure 1. In many cases, if all relevant measures were truly

accounted for in a model, the residual effect of race would approach zero and there would be little to no independent effect of race. In either case, there may be some or no "residual effect of race" depending on how race is operationalized and on what other variables are included in the model in which the race term is used.[12].

Second, and perhaps more helpfully, the exposure design can lessen problems of post-treatment bias (Greiner and Rubin 2010), but requires researchers' vigilance. To illustrate, suppose we are interested in whether a bank offers loans to minority versus non-minority applicants at different rates. The ideal experiment would be to mimic an audit study and create identical loan applicants whose profiles differ only with regard to how they are categorized into different racial groups. The "treatment" would be administered to the loan officer at the time he or she reviews the application packet. Anything that happens before is solidly pre-treatment and must be conditioned on; this would include anything that could potentially appear on an application for a loan. Anything that happens after the decision maker reaches a decision (e.g., extending additional credit, the size of the loan) would be post-treatment and should be dropped from the statistical model (Greiner and Rubin 2010). Again, drawing an analogy to the ideal exposure study is helpful in assessing which covariates could be construed pre-treatment and which could be construed post-treatment.

This discussion can be boiled down to one key idea: when possible, conceptualizing an experiment or observational study as an exposure to a racial signal study greatly reduces both the theoretical and practical problems associated with making race-based causal inferences. Thus, applied researchers should think carefully about whether an

[12]As there is no way to measure "unobserved" confounders, we note that one useful way of at least estimating their potential effects is via sensitivity analyses. These sensitivity tests place bounds on the size of the confounding that one would have to see among the treated group (e.g., the racial minority group) in order to render insignificant those effects that have been detected. Some useful examples of this are found in (Greiner and Rubin 2010), with a discussion of the methodology found in Keele (2010) and Rosenbaum (2002)

exposure study could provide a well-suited analogy for their research questions and hypotheses.

Research Design 2: Within-Group Designs

Many research questions do not involve a straightforward actor exposed to a racial cue: Why is the lifetime risk of developing diabetes higher for Hispanics than for other groups? Why are certain ethnic groups overrepresented in rebel militias? In these studies, there is generally no clean treatment by exposure to a racial cue and no "decisionmaker" (to use the terminology of Greiner and Rubin (2010)). (VanderWeele and Hernán (2012) refer to these studies as those focusing on "discrepancies.") These sorts of studies are often attempting to understand how a part of race shapes the larger whole. For scholars working on these sorts of topics, the primary research interest – and the appropriate unit of analysis – lies in a particular racial or ethnic population itself. And these studies are particularly problematic in terms of having ill-defined potential outcomes and post-treatment bias problems.

For these sorts of questions, we suggest a different research design, one that exploits variation *within* a racial or ethnic group, as opposed to across racial or ethnic groups. The within-group design disaggregates the "bundle of sticks" and singles out a specific constitutive element of race or ethnicity that can be manipulated in an experiment (or observed to vary) within a group. For within-group research designs, (1) one or more constitutive elements of race that exhibit within-group variation are identified as a treatment; (2) members of the group are assigned to the treatment and control conditions (or are observed to vary across the conditions); (3) the units of analysis are the individual members of the group. As with the exposure to racial cue approach, these steps help mitigate the problems of race and causality. These steps also help isolate causal mechanisms

and help scholars think more clearly about what could be more tractable and meaningful policy interventions.

For example, suppose we are interested in understanding disparate educational outcomes for black versus white youngsters. A naive analysis would be to regress educational outcomes on race (possibly other control variables), taking the group of African Americans as the "treated" group and whites as the "control," possibly controlling for other relevant variables. For all the reasons cited above, however, a causal estimate based on this research design would be (1) fundamentally unidentified and (2) biased by any inclusion of post-treatment variables.[13] Furthermore, such a naive regression would not isolate *why* black youngsters fare worse in terms of an education gap; after all, a statistically significant coefficient on the "black" variable would simply reveal that a difference continues to exist. Lastly, such a design would probably not help shed light on potential policy interventions that could ameliorate such discrepancies.[14]

A better research design would take as its starting point the fact that race is comprised of a variety of factors, and, rather than conceive of black youngsters as a treated group and white youngsters as the control, identifies a trait that is (1) a possible explanation for the gap, (2) collinear with race, but not perfectly so, and (3) in theory, manipulable. One example of such a trait might be neighborhood. With the long history of residential segregation in America, race and neighborhood are distinct but highly collinear. Neighborhood effects, through factors like variation in the quality of local schools or police,

[13] A plausible way to re-think the research design in this example would be to take an SES variable as the treatment of interest and race or ethnicity as the pre-treatment confounder. This would represent different inquiry, albeit an interesting one.

[14] We note that it might be tempting to try mediation analysis with these types of questions. For example, one could treat family income as a kind of mediator. Identifying the effect of race on an outcome that passes through income would be difficult, however, without very strong assumptions. For example, to use traditional mediation analysis, race would have to be the only factor affecting income (Imai et al. 2011), an assumption that is clearly not met.

could plausibly explain part of the achievement gap and neighborhood can be varied in ways that race cannot.

With this in mind, we can re-cast the study as a *within-group analysis* where we compare academic achievement by black youngsters from, say, high-poverty neighborhoods to similarly situated black youngsters in less high-poverty neighborhoods. The Moving to Opportunity experiment, which incorporated random assignment of housing vouchers, offers one example of just such a design (Katz, Kling, and Liebman 2001). By identifying meaningful within-group differences, scholars can narrow the causal mechanisms that explain disparate, across-race outcomes.

There are several advantages to this research design over more naive cross-race regression approaches. First, limiting the unit of analysis to a single racial group and conceptualizing the treatment as being something that varies closely, but perhaps not exclusively, with race allows for experimental manipulation, in theory or practice. This not only permits us to avoid the critique that no well-defined potential outcomes exist, but it also means that we think of meaningful policy interventions to address race-related discrepancies. Second, because the alternate treatment may be "assigned" post-birth, it also allows for the inclusion of all pre-treatment variables (confounders), including traits like mother's education, health, nutrition, and early educational opportunities. In this regard, we could think of race or ethnicity as a confounding variable that can be controlled for or conditioned on.[15] Third, with enough data, conditioning on race before moving to a causal analysis resolves the common support problem; it might be difficult to find a

[15]For example, intervening on things like neighborhood, mother's education, health, nutrition, and educational opportunities could have different effects across different groups – a kind of effects modification. Because the impact of the alternate treatment may vary according to subgroup, comparing the results between groups may also be useful. In our neighborhoods example, including comparisons with white children in the analysis might shed some light on these issues, but probably not help with regard to making meaningful causal inferences.

sufficient number of similarly situated individuals across racial groups but focusing on within-race variation will often resolve this problem.

Experimental Within-Group Studies. A growing number of experimental studies, particularly in psychology, use the within-group approach. Walton and Cohen (2011), for example, randomly assigns freshman to receive a message that all college students struggle to fit in initially but can ultimately succeed. In this case, the constitutive element of race is an uncertain sense of belonging for stigmatized groups in places like school or work. Compared to the black control students, the black treated students exhibited substantial sustained academic improvements over their college careers and later reported being happier and healthier than the black controls. Walton and Cohen (2011) also included a white comparison group and found that treated whites exhibited no significant differences from the control group whites. Put another way, uncertainty about social belonging in college appears to be sufficiently collinear with race as to be constitutive for African Americans yet immaterial for whites. At the same time, feelings of social belonging are sufficiently malleable that a simple exercise lasting about 45 minutes could dramatically change outcomes for treated black students as compared to black controls.

In political science, Gay (2012) builds on the Moving To Opportunity experiment and investigates the role of high poverty neighborhoods on voting. Gay finds that poor families offered vouchers to leave public housing turn out to vote at lower rates. Though Gay's analysis is not explicitly focused on explaining the effects of neighborhood as an element of race, the sample population in the study is nearly two-thirds black and nearly one-third Latino. As such, the analysis is implicitly a study of the role of neighborhood context and social dislocation as elements of race in minority turnout. Valenzuela and Michelson (2013) also explore the role of neighborhood context in a get out the vote ex-

	Research Design Type	
	Exposure	Within-Group
Unit	Individuals or institutions, potentially from any group	Members of a particular group
Typical Treatment	Racial cue or signal (e.g., include distinctively ethnic names on a resume)	Constitutive element of the composite of race (e.g., address anxiety about social belonging in college)
Role of element of race	One 'stick' is a *proxy* for the bundle (e.g., dialect signals many traits associated with race to a landlord)	One 'stick' explains *part* of the bundle (e.g., Middle Passage might explain part of high rates of hypertension among African Americans)
Examples	Correspondence and audit studies, Implicit Association Tests	Experimental manipulation of a constitutive psychological dimension of race, within-race matching

Table 2: Overview of exposure and within-group research designs.

periment by comparing the differential resonance of ethnic and national identity appeals across middle class and working class Latino communities.

Observational Within-Group Studies. Observational studies have also successfully leveraged components of race in order to extract surprising inferences. Sharkey (2010) exploits temporal variation in local homicides in Chicago to identify a significant neighborhood effect of proximity to violence on the cognitive performance of African American children. Cutler, Fryer, and Glaeser (2005) investigate why African Americans suffer from higher rates of hypertension compared to whites. By more closely examining black subpopulations, they demonstrate that blacks whose enslaved ancestors survived the "Middle Passage" across the Atlantic exhibit higher rates of salt sensitivity compared with blacks whose ancestors were not enslaved (i.e., more recent African immigrants to the United

States or the United Kingdom). A possible mechanism is that salt retention – a precursor to hypertension – enabled enslaved Africans to survive the deadly three-month sea voyage that constituted the Middle Passage. Thus, the appropriate "treatment" in this study was having ancestors who were subjected to the Middle Passage. As no European Americans were subjected to the Middle Passage, the "treatment" is highly collinear with being African American but not necessarily with being of African descent, a finding only made clear by within-group comparisons.

Nisbett and Cohen (1996) investigate high rates of violence among men in the American South. A typical cross-race approach, as is often used in fields such as health and education, might have compared rates of violence among white and black men. Due to post-treatment bias, such comparisons are problematic when attempting to provide anything more than a descriptive analysis. Nisbett and Cohen, by contrast, exploit within-group variation among whites and avoid such pitfalls. Through both observational data and experiments, Nisbett and Cohen identify specific cultural traits that vary between Southern and Northern white men which influence attitudes, physiology and differential rates of violence.

As with other studies relying on observational data, researchers using within-group designs should consider experimental analogies. This is a point that has been made by the causal inference and econometrics literature, but is particularly worthwhile for those specifically interested in race (Angrist and Pischke 2009). Keeping an eye on what the ideal experiment would look like (and what factors would or would not have to be controlled for) is essential for thinking clearly about potential identification strategies and problems. In addition, given the absence of randomization, researchers using within-group designs with observational data should use tools like matching and inclusion of pre-treatment variables in regressions to address the ignorability assumption. Table 2, summarizes key aspects of the exposure and within-group designs.

Combined Exposure and Within-Group Designs

We also note, briefly, that it is possible in at least four cases to combine aspects of the two prior designs. First, some researchers may wish to use exposure designs solely with particular racial or ethnic sub-groups. In this case, within-group variation is introduced by exposure to a racial cue and the subject pool is narrowed to reduce heterogeneity among the observations. Lee and Pérez (2013), for example, evaluate language-of-interviewer effects on Latino public opinion and find substantial differences in respondents' attitudes and reporting of political facts.

Second, some studies may be interested in how subjects respond to racial or ethnic cues in which at least some of the variation in signals occurs within rather than across groups. Adida, Laitin, and Valfort (2010), for example, apply to jobs with French employers in which resume names have been randomly assigned to signal a person of Senegalese and Christian background, Senegalese and Muslim background or a "typical French republican" background with no religious affiliation. Hopkins (2014) exploits differences in immigrant skin tone, language and accent to experimentally vary within-group racial cues in the context of a TV news segment. In this design, subjects – potentially of any background – are exposed to cues but, in this case, the signals are not exclusively cross-racial or cross-ethnic.

Third, a combined design can be useful for assessing interaction effects between within-group traits and exposure to a cue. Valenzuela and Michelson's 2013 study, for example, compared receptivity to ethnic or national group identity cues across Latino subgroups. This design allows for an estimate of the joint effect of a within-group trait (in this case, the class characteristics of the neighborhood) with priming effects of exposure to a cue. Here, the unit of analysis is the same as that of a within-group design in which the subjects are members of a single group and in which variation of some constitutive element of the group is exploited for causal inference. In essence, each subject receives two treat-

ments (i.e., within-group neighborhood characteristics and racial or ethnic cue) and this design allows for causal inference about the combined effect.

Fourth, scholars may wish to compare results of an exposure study both within-group and across-group. These sorts of studies typically involve two racial or ethnic groups that each have a separate treatment and control subgroup. Walton and Cohen (2011), mentioned previously, create black treated, black control, white treated and white control groups. The treatment is exposure to media and some simple exercises that are designed to address anxieties about social belonging. The results of the social belonging intervention, big benefits for treated black students and essentially no effect for whites, are discernible only by combining both the exposure to a racial cue and two within-group designs.

Towards A Unified Framework for Race and Causality

In this paper, we proposed a new way of thinking about estimating causal effects of race and ethnicity. First, we argued that social scientists should reconsider how they are theorizing and operationalizing race. As shown by Morning (2011), the debate between essentialists and constructivists is far from resolved. In contrast to essentialist or "immutable characteristics" approaches, we argue here that a "bundle of sticks" better represents how race and ethnicity operate in the world. Moreover, operationalizing race as composite and disaggregable is more amenable to causal inference. Immutable and manipulable need not be incompatible. For those social scientists already disaggregating race but lacking any theoretical framework, our approach clarifies the relationship between an element of race being studied and the larger bundle. Rather than simply assuming connections, scholars can state that a particular element of race is a part of the larger composite or they can explain that the element of race is serving as a proxy for the whole.

Second, we have generalized two research designs appropriate for investigating causal effects of seemingly immutable characteristics. The exposure design may be particularly appropriate for those studying public opinion, political behavior, implicit bias, stereotype threat, law, and public policy – fields in which questions of interest frequently involve how institutions or individuals view and interact with racial signals and cues. For research focusing on features of particular populations, we encourage consideration of within-group designs that exploit constitutive, varying and manipulable elements of race. Even though some aspects of race may not lend themselves to manipulation, many highly collinear elements of race may be experimentally manipulated or observationally assessed. To be clear, there remain many important questions and cases that are beyond the scope the approaches we present and appropriate elements of race may not always available. Nevertheless, some elements may vary closely with race, may not already be included in the analysis, and may explain a significant part of the larger bundle.

Finally, we also recommend the "bundle of sticks" approach as it forces researchers to consider exactly what is being captured by racial identification variables. The multifaceted nature of race and ethnicity suggest that when race is operationalized as a stable, homogenous entity (e.g., a simple dummy or categorical variable like "1" if white, "0" if non-white), any statistical association will typically offer little or no insight as to which elements are the key mechanisms of action – be it fear of an out-group, neighborhood effects or some other factor. Also, just as it is difficult to imagine a way to assign race experimentally, so to is it difficult to translate research identifying simple racial or ethnic disparities into meaningful policy interventions. A "word gap" in early childhood language exposure, for example, suggests much clearer interventions than a persistent "black-white test score gap." More broadly, the challenges posed by ethnic conflict and racial inequality are much more likely to be understood and addressed if scholars dis-

aggregate the elements of race and identify the particular ways difference is turned into disparity.

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