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## ESSAY

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### ABORTION RIGHTS AND THE LARGENESS OF THE FRACTION $\frac{1}{6}$

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#### INTRODUCTION

The most important abortion rights Supreme Court case in decades may hinge on the answer to a seemingly trivial question—is  $\frac{1}{6}$  a large fraction?

Last year, the Fifth Circuit answered by stating, with minimal analysis, that  $\frac{1}{6}$  is *not* a large fraction.<sup>1</sup> The impact of this assertion is potentially enormous. The state of Texas’s recently-enacted abortion regulations—which require doctors who work at abortion clinics to obtain admitting privileges at local hospitals and mandate that clinics where abortions are performed meet the exacting standards of ambulatory surgical centers—were found to be constitutional.<sup>2</sup> As a result, a state that used to have over 40 clinics could have only 8 or 9.<sup>3</sup>

In this article, we challenge the Fifth Circuit’s description of the fraction  $\frac{1}{6}$ . We do so by empirically testing whether individuals consider  $\frac{1}{6}$  a large fraction in different scenarios. We find that the Fifth Circuit’s understanding of  $\frac{1}{6}$  is at odds with the common semantic understanding of

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<sup>1</sup> *Whole Woman’s Health v. Cole*, 790 F.3d 563, 588 (5th Cir. 2015).

<sup>2</sup> *Id.* at 567, 576.

<sup>3</sup> *Id.* at 578. The clinics remain open now pursuant to an emergency stay from the Supreme Court, *Whole Woman’s Health v. Cole*, 135 S. Ct. 2923 (2015) (mem.), which will hear oral argument March 2, 2016.

the fraction. In particular, our study produces four conclusions that are inconsistent with the Fifth Circuit's analysis:

- (i) In particular scenarios, an overwhelming majority of people characterize  $\frac{1}{6}$  as a large fraction.
- (ii) The expected outcome of a scenario influences whether people describe  $\frac{1}{6}$  as a large fraction.
- (iii) A large majority of people can sometimes consider fractions larger than  $\frac{1}{6}$  to be small, and fractions smaller than  $\frac{1}{6}$  to be large.
- (iv) In politically-charged scenarios, political orientation can affect whether a person perceives  $\frac{1}{6}$  as a large fraction.

What this means for the case before the Supreme Court is quite simple—that the Fifth Circuit's analysis of whether  $\frac{1}{6}$  is a large fraction has no basis in the everyday understanding of the term "large fraction" or of the fraction  $\frac{1}{6}$  itself. When the Supreme Court decides this case, it should heed this conclusion and offer a more thoughtful analysis of this potentially decisive question.

## I. WHY THE "LARGE FRACTION" LABEL MATTERS

Why is this so important? How does the seemingly inane question of whether  $\frac{1}{6}$  is a large fraction potentially determine the future of abortion rights, not only for the women of Texas, but also possibly for the people of the United States? The key lies in the development of case law about facial challenges to a statute's constitutionality.

### A. *General Facial Unconstitutionality Test*

A litigant can bring two types of constitutional challenges against a statute: facial and as-applied.<sup>4</sup> An as-applied challenge is a challenge to the statute based on the facts as the statute is applied to the plaintiff. It seeks to invalidate a specific application of a statute. For instance, in the abortion context, several states have laws outlawing abortions after 20 weeks of pregnancy. Imagine a woman who is 22 weeks pregnant when her doctor discovers an extreme fetal abnormality that would almost certainly result in fetal death in the womb or, if the pregnancy goes to full term, certain death of the baby. Seeking to limit the ensuing emotional and physical trauma, the

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<sup>4</sup> See, e.g., Michael C. Dorf, *Facial Challenges to State and Federal Statutes*, 46 STAN. L. REV. 235 (1994). But see Richard H. Fallon, Jr., *Commentary, As-Applied and Facial Challenges and Third-Party Standing*, 113 HARV. L. REV. 1321, 1324 (2000) (arguing that "there is no single distinctive category of facial, as opposed to as-applied, litigation" but only different doctrinal rules for enforcing different constitutional provisions).

woman wants to terminate her pregnancy at 22 weeks. However, she is barred from doing so by the law banning abortions after 20 weeks.

Her challenge to the law would be an as-applied challenge. The litigation would focus on whether the ban on abortions after 20 weeks was constitutional in her specific case—a 22-week pregnancy that would certainly result in either fetal death or the baby dying almost immediately after birth. The plaintiff would introduce evidence about the particular fetal abnormality, its effects on her and the fetus, and the state interest in prohibiting abortion under these circumstances. Stated more generally, the litigation in this as-applied challenge would be about these particular facts for this particular woman. Accordingly, if this woman were to win, the remedy would be that the law could not be applied to her, but would still be generally applicable to others.<sup>5</sup>

A facial challenge is different. A facial challenge is a general challenge to the statute's constitutionality, not based on any particular set of facts. It seeks to invalidate the statute in all applications. Taking the example of the 20-week ban on abortion, a facial challenge would not concern a particular woman and her pregnancy's fetal abnormality. Instead, a facial challenge considers whether this abortion ban is generally constitutional. Thus, the typical plaintiff in a facial challenge to an abortion regulation is not a woman litigating her particular pregnancy but rather doctors or clinics litigating on behalf of all the women who might come to them for an abortion. The typical remedy for a facial challenge is a finding that the law is generally unconstitutional, not simply unconstitutional for one particular person.<sup>6</sup>

This high-level sketch of the differences between as-applied and facial challenges to the constitutionality of statutes elides the reality that many scholars have noted—that these categories are far from clearly delineated and that the Supreme Court routinely clouds the picture with confusing declarations about the differences or commonalities between the two.<sup>7</sup> Nonetheless, it is clear that the Supreme Court believes that “facial challenges should be rare and difficult to mount successfully.”<sup>8</sup>

The prevailing test for determining facial unconstitutionality reflects this understanding. In *United States v. Salerno*, the Court explained what a litigant would need to do to prove that the Bail Reform Act was facially

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<sup>5</sup> This is how the Court suggested impacted women address the Partial-Birth Abortion Ban Act of 2003 in *Gonzales v. Carhart*, 550 U.S. 124, 167-68 (2007). In a dissent, Justice Ginsburg was highly critical of the feasibility of an as-applied challenge in the abortion context. *Id.* at 189-90 (Ginsburg, J., dissenting).

<sup>6</sup> See generally *City of Los Angeles v. Patel*, 135 S. Ct. 2443, 2449-51 (2015).

<sup>7</sup> E.g., Richard H. Fallon, Jr., *Fact and Fiction About Facial Challenges*, 99 CALIF. L. REV. 915, 922-23 (2011); Edward A. Hartnett, *Facial and As-Applied Challenges to the Individual Mandate of the Patient Protection and Affordable Care Act*, 46 U. RICH. L. REV. 745, 747-48 (2012).

<sup>8</sup> *The Supreme Court, 2014 Term—Leading Cases*, 129 HARV. L. REV. 181, 246-47 (2015).

unconstitutional: “A facial challenge to a legislative Act is, of course, the most difficult challenge to mount successfully, since the challenger must establish that no set of circumstances exist under which the Act would be valid.”<sup>9</sup> The Court called this burden on the challenger “heavy” because “[t]he fact that the Bail Reform Act might operate unconstitutionally under some conceivable set of circumstances is insufficient to render it wholly invalid.”<sup>10</sup> If there were such a set of circumstances, the challenger would have to bring an as-applied challenge based on how the law “was applied to the particular facts of their case.”<sup>11</sup>

### B. *The Abortion Facial Unconstitutionality Test*

This test for facial unconstitutionality has exceptions. *Salerno* itself acknowledged one exception in the context of First Amendment claims of overbreadth.<sup>12</sup> Subsequent to *Salerno*, the Court developed a second exception for abortion claims. In *Planned Parenthood of Southeastern Pennsylvania v. Casey*, the Court’s plurality not only announced the newly-minted “undue burden” standard for challenges to abortion restrictions,<sup>13</sup> but also created a new rule for facial challenges in the context of abortion.

In evaluating Pennsylvania’s requirement that married women notify their husbands before obtaining an abortion, the *Casey* plurality used a less exacting standard than the *Salerno* rule. It stated instead that an abortion law could be found facially unconstitutional if “in a large fraction of the cases in which [the law] is relevant, it will operate as a substantial obstacle to a woman’s choice to undergo an abortion.”<sup>14</sup>

The husband-notification provision was unconstitutional under this new facial invalidity test. Under the *Salerno* test, the law would have survived because the restriction imposed “no burden at all for the vast majority of women seeking abortions” because “only about 20 percent of the women who obtain abortions are married” and a large percentage of them presumably have no objection to notifying their husbands.<sup>15</sup> Looking instead at the restriction’s “impact on those whose conduct it affects,” the plurality found that domestic violence is a real and pressing concern for a “large fraction” of women who

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<sup>9</sup> 481 U.S. 739, 745 (1987).

<sup>10</sup> *Id.*

<sup>11</sup> *Id.* at 745 n.3.

<sup>12</sup> *Id.* at 745 (citing *Schall v. Martin*, 467 U.S. 253 (1984)).

<sup>13</sup> 505 U.S. 833, 895 (1992) (plurality opinion).

<sup>14</sup> *Id.* As the plurality explained earlier in the opinion, the “substantial obstacle” language is the operative rule for the new “undue burden” test: “A finding of an undue burden is a shorthand for the conclusion that a state regulation has the purpose or effect of placing a substantial obstacle in the path of a woman seeking an abortion of a nonviable fetus.” *Id.* at 877.

<sup>15</sup> *Id.* at 894.

do not want to notify their husbands.<sup>16</sup> For those women, the requirement was a substantial obstacle; thus, the provision was struck down as an unconstitutional undue burden.<sup>17</sup>

The Court followed this new “large fraction” test for facial invalidity in subsequent abortion cases. Fifteen years later, while questioning whether the test was consistent with past cases, the Court found a federal law outlawing a particular type of abortion procedure facially constitutional because the challengers “ha[d] not demonstrated that the [law] would be unconstitutional in a large fraction of relevant cases.”<sup>18</sup>

### C. *Texas and the “Large Fraction” Test*

The “large fraction” test is a key part of the ongoing litigation over Texas’s recently-enacted abortion restrictions. In the summer of 2013, Texas enacted several new restrictions on abortion, two of which are now before the Supreme Court in *Whole Woman’s Health v. Hellerstedt*<sup>19</sup>: (1) a requirement that all physicians who perform abortions obtain admitting privileges at a local hospital, and (2) a requirement that all clinics where abortions are performed meet the standards of an ambulatory surgical center (ASC).<sup>20</sup> If fully implemented, these two requirements would reduce the number of licensed abortion clinics in Texas from the over 40 that existed before the new law was enacted to 8 or 9.<sup>21</sup>

The current challenge to the Texas requirements is a combined as-applied and facial challenge.<sup>22</sup> In September 2014, the district court enjoined the law, but in June 2015, the Fifth Circuit largely reversed.<sup>23</sup> The Fifth Circuit began its discussion of the facial challenge by expressing uncertainty about which of the different facial challenge standards to apply:

Facial challenges relying on the effects of a law impose a heavy burden upon the parties maintaining the suit. In the abortion context, it is unclear whether a facial challenge requires showing that the law is invalid in all

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<sup>16</sup> *Id.* at 894-95.

<sup>17</sup> *Id.*

<sup>18</sup> *Gonzales v. Carhart*, 550 U.S. 124, 167-68 (2007).

<sup>19</sup> Certiorari was granted under the name *Whole Woman’s Health v. Cole*, 136 S. Ct. 499 (2015) (mem.), although the case was recaptioned before argument. Docket, *Whole Woman’s Health v. Hellerstedt*, No. 15-274 (U.S.) (last updated Feb. 12, 2016).

<sup>20</sup> *Whole Woman’s Health v. Cole*, 790 F.3d 563, 576 (5th Cir. 2015).

<sup>21</sup> *See id.* at 578 (listing facts stipulated to by the parties).

<sup>22</sup> *Id.* at 566.

<sup>23</sup> *Id.* at 577, 596, 598.

applications (the general test applied in other circumstances) or only in a large fraction of the cases in which the law is relevant (the test applied in *Casey*).<sup>24</sup>

Nonetheless, the court concluded that in order to succeed, the facial challenge must show “at a minimum” that “a large fraction” of Texas women of reproductive age are unduly burdened by the new requirements.<sup>25</sup>

Conducting that analysis, the Fifth Circuit found no such large fraction burdened. Based on the plaintiffs’ expert witness, the court said that 900,000 Texas women of reproductive age would have to travel more than 150 miles to obtain an abortion after both the admitting privileges and ASC requirements took effect.<sup>26</sup> There are approximately 5.4 million women of reproductive age in Texas; thus,  $\frac{1}{13}$  of Texas women of reproductive age would have to travel 150 miles or more due to the admitting privileges requirement, and  $\frac{1}{6}$  of them would have to travel that distance due to the combination of the admitting privileges and ASC requirements.<sup>27</sup>

Applying the “large fraction” test, the court agreed with and adopted the reasoning of the panel of Fifth Circuit judges who heard Texas’s motion for an emergency stay months earlier:

Even assuming, *arguendo*, that 150 miles is the relevant cut-off, this is nowhere near a large fraction . . . . The general standard for facial challenges . . . [is that] the law must be unconstitutional in 100% of its applications. We decline to interpret *Casey* as changing the threshold for facial challenges from 100% to 17% [or  $\frac{1}{6}$ ].<sup>28</sup>

Putting a final exclamation point on its reasoning, the court scoffed at the possibility that  $\frac{1}{6}$  would ever be a “large fraction” by noting that, in defending their position, plaintiffs “hardly argue that these numbers amount to a large fraction” but rather challenge the denominator.<sup>29</sup> The court concluded its analysis by stating that “the Plaintiffs failed to prove that the ASC requirement imposes an undue burden on a large fraction of women for whom it is relevant.”<sup>30</sup>

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<sup>24</sup> *Id.* at 586 (internal quotation marks and citations omitted).

<sup>25</sup> *Id.*

<sup>26</sup> *Id.* at 588. This analysis relied upon a prior Fifth Circuit holding that traveling less than 150 miles to obtain an abortion was not an undue burden. *Id.* (citing *Planned Parenthood of Greater Tex. Surgical Health Servs. v. Abbott (Abbott II)*, 748 F.3d 583, 598 (5th Cir. 2014)).

<sup>27</sup> *Id.*

<sup>28</sup> *Id.* (quoting *Whole Woman’s Health v. Lakey*, 769 F.3d 285, 298 (5th Cir. 2014), other internal quotation marks and citations omitted).

<sup>29</sup> *Id.* at 589. The issue of what constitutes the denominator (all women in Texas of reproductive age or the subset of such women in areas of Texas that will be most affected by the restrictions) is also important and could likewise be decisive, but is beyond the scope of this analysis.

<sup>30</sup> *Id.* at 590.

*D. Other Lower Courts and the “Large Fraction” Test*

The Fifth Circuit’s analysis of the “large fraction” test in this case is consistent with prior Fifth Circuit cases, but not with several other lower federal courts. In the facial challenge to the Texas admitting privileges requirement (a separate case from the one currently before the Supreme Court), the Fifth Circuit said that a “large fraction” is greater than a “significant” one.<sup>31</sup> It explained further that a restriction that “does not fall on the vast majority of Texas women seeking abortions” cannot be a “large fraction.”<sup>32</sup> Applying that standard, the court found that the less than 10% of Texas women who had to travel more than 100 miles because of the admitting privileges requirement did not constitute a “large fraction.”<sup>33</sup>

In 2006, the Sixth Circuit engaged in a very similar analysis in a challenge to Ohio’s requirement that women receive an informed-consent lecture in person at least 24 hours prior to obtaining an abortion.<sup>34</sup> The court determined that this provision would be an almost insurmountable barrier for about 12% of Ohio women.<sup>35</sup> Nonetheless, the court held this was not a “large fraction” because:

To date, no circuit has found an abortion restriction to be unconstitutional under *Casey*’s large-fraction test simply because some small percentage of the women actually affected by the restriction were unable to obtain an abortion. Although a challenged restriction need not operate as a *de facto* ban for all or even most of the women actually affected, the term “large fraction,” which, in a way, is more conceptual than mathematical, envisions something more than the 12 out of 100 women identified here.<sup>36</sup>

On the other hand, the Eighth Circuit held that a restriction that burdens about 18% of minors is unconstitutional.<sup>37</sup> The court reviewed South Dakota’s requirement that doctors must notify a minor’s parent 48 hours before performing an abortion.<sup>38</sup> The statute had an exception for minors with abusive parents, but the court nonetheless found that the exception was not broad enough to include minors for whom an abortion was in their best interest but who had stressful, though not abusive, relationships with their parents.<sup>39</sup> Because 18% of minors in South Dakota live in single-parent

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<sup>31</sup> *Abbott II*, 748 F.3d 583, 600 (5th Cir. 2014).

<sup>32</sup> *Id.*

<sup>33</sup> *Id.* at 598.

<sup>34</sup> *Cincinnati Women’s Servs., Inc. v. Taft*, 468 F.3d 361, 364-65 (6th Cir. 2006).

<sup>35</sup> *Id.* at 373.

<sup>36</sup> *Id.* at 374.

<sup>37</sup> *Planned Parenthood, Sioux Falls Clinic v. Miller*, 63 F.3d 1452, 1463 (8th Cir. 1995)

<sup>38</sup> *Id.* at 1454.

<sup>39</sup> *Id.* at 1458-62.

homes, there would be no other parent to notify. The court concluded that the total burdened group amounts to a “large fraction of minors seeking pre-viability abortions [who] would be unduly burdened.”<sup>40</sup>

Interpreting this case in a later decision, the District of South Dakota took a markedly different approach than the Fifth and Sixth Circuits. The court rejected the requirement that a “large fraction” be the same as a majority (or more) of women.<sup>41</sup> It reasoned that “[i]f the plurality opinion in *Casey* intended ‘large fraction’ to mean a majority, it would have said majority.”<sup>42</sup> The court referred to the 18% in the Eighth Circuit’s decision in *Miller* as “not establishing the bottom end of what constitutes a ‘large fraction’” but as coming “the closest.”<sup>43</sup>

A district court in Indiana went even further, finding that an in-person counseling requirement would likely result in a drop in the number of women obtaining an abortion by 11% to 14%.<sup>44</sup> The court stated, without analysis, that this was a “large fraction of women seeking abortions” and found, on a motion for preliminary injunction, that the in-person requirement was likely unconstitutional.<sup>45</sup>

## II. WHEN DO PEOPLE PERCEIVE $\frac{1}{6}$ AND OTHER FRACTIONS AS LARGE?

Given both this split among the lower federal courts and the looming importance of the Supreme Court’s determination in the Texas case it is currently considering, we examined whether, and under what circumstances, individuals view  $\frac{1}{6}$  and other fractions as large.

To do this, we developed a questionnaire and distributed it to potential respondents through Amazon’s Mechanical Turk system.<sup>46</sup> The questionnaire

<sup>40</sup> *Id.* at 1462-63, 1462 n.10 (considering minors with stressful relationships with a single parent, with parents who might prevent their abortions on grounds other than the minor’s best interest, and with abusive parents who were unable to use the bypass procedure as components of the burdened group).

<sup>41</sup> *Planned Parenthood Minn., N.D., S.D. v. Daugaard*, 799 F. Supp. 2d 1048, 1061 (D. S.D. 2011).

<sup>42</sup> *Id.*

<sup>43</sup> *Id.* at 1062.

<sup>44</sup> *A Woman’s Choice—E. Side Women’s Clinic v. Newman*, 904 F. Supp. 1434, 1462 (S.D. Ind. 1995).

<sup>45</sup> *Id.*; see also *June Med. Servs. LLC v. Kliebert*, No. 14-0525, 2016 WL 320942, at \*48 (M.D. La. Jan. 26, 2016) (finding between 45% and 99% to be a “large fraction” in the context of burdens on abortion access).

<sup>46</sup> Amazon’s Mechanical Turk (mTurk) system allows individuals and businesses to create and post surveys that Amazon’s members can then take for minimal compensation. Research using data collected via mTurk is becoming increasingly common in the social and behavioral sciences. mTurk samples, while not perfectly representative of the general U.S. population, tend to be more similar to the U.S. population than other widely-used data, such as standard Internet surveys or convenience samples of college students, and the results of many experiments have been successfully replicated in mTurk samples. See generally Adam J. Berinsky et al., *Evaluating Online Labor Markets for Experimental Research: Amazon.com’s Mechanical Turk*, 20 POL. ANALYSIS 351 (2012); Michael



consisted of 23 questions.<sup>47</sup> Fourteen of them involved hypothetical scenarios in which fractions, usually  $\frac{1}{6}$ , were presented. After each scenario, respondents were asked whether they considered that fraction to be large.<sup>48</sup> We ended up with a sample of 504 usable respondents,<sup>49</sup> all of whom were English speakers over the age of 18. The sample was heterogeneous across race, sex, age, and political identity.<sup>50</sup>

We used the data from this survey to address several research questions. First, we examined whether the Fifth Circuit's finding—that  $\frac{1}{6}$  is “nowhere near” being a large fraction and that only a “vast majority” can possibly constitute a large fraction—is consistent with common understanding of the number  $\frac{1}{6}$  and the term “large fraction.” Table 1 shows the questions and responses testing this contention; the responses are also shown in Figure 1.

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Buhrmaster et al., *Amazon's Mechanical Turk: A New Source of Inexpensive, Yet High-Quality, Data?*, 6 PERSP. ON PSYCHOL. SCI. 3 (2011).

<sup>47</sup> Interested readers may take the survey at [https://publichealthgwu.az1.qualtrics.com/jfe/form/SV\\_bqLjm9n3n19xoP3](https://publichealthgwu.az1.qualtrics.com/jfe/form/SV_bqLjm9n3n19xoP3).

<sup>48</sup> There were nine other questions. Three questions covered respondents' demographic characteristics: race/ethnicity, sex, and age. Two questions assessed indicators of political orientation: how they voted the last time they voted in a U.S. presidential election, and where they placed themselves on a scale from very conservative to very liberal. Two questions at the beginning of the questionnaire screened potential participants on basic comprehension of simple fractions. And two questions placed approximately one-third and two-thirds of the way through the questionnaire were used to screen out respondents who were clicking responses without reading the questions.

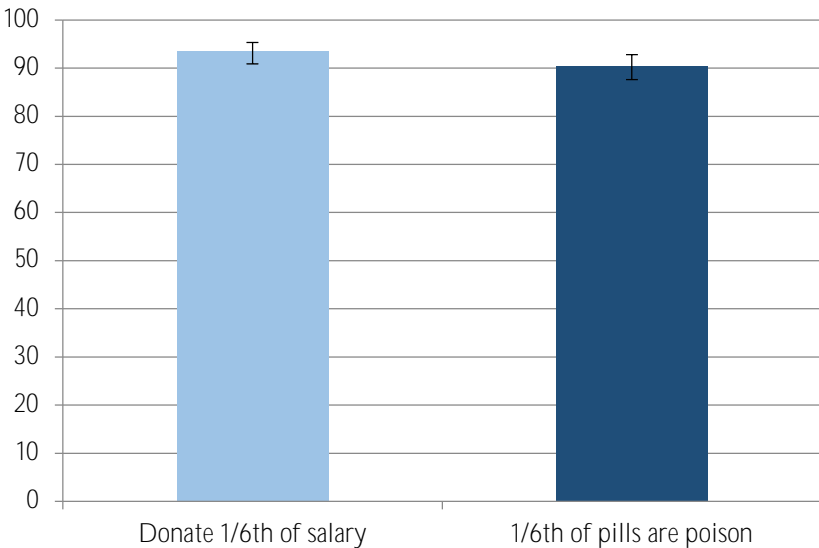
<sup>49</sup> A total of 527 individuals completed at least part of the survey, but we excluded 16 on the basis of incorrect answers on the fraction-screening questions and another 7 on the reading-validation questions.

<sup>50</sup> Most respondents described their race as white (76%), but quite a few described their race in other ways (7% African American, 3% Hispanic or Latino, 9% Asian or Pacific Islander, 1% Other, and 4% Multiple Races). The majority of the sample was male (57%), but a substantial minority was female (43%). In terms of age, the sample was relatively young, with well over half of participants under 35 years of age. The mean age was 34.6 years, and the range was 18 to 76 years. Participants were more likely to say that they voted for the Democratic Party's candidate in the last presidential election (48%) than for the Republican Party's candidate (22%). Although greater proportions described themselves as “very liberal” or “liberal” (53%) than as “very conservative” or “conservative” (24%), there was considerable variation in respondents' self-reported political orientations.

**Table 1: Percent (and 95% confidence interval) of respondents answering “yes” to the question: “In this scenario, do you consider  $\frac{1}{6}$ th to be a large fraction?”**

Scenario	Percent	(95% CI)
Your take-home pay over the course of a year is \$60,000, all of which you use for necessary expenses. Your boss asks you to donate $\frac{1}{6}$ th of your take-home pay to her daughter’s elite private school.	93.5	(90.9-95.3)
A bottle of Tylenol contains 120 tablets, all of which are identical in appearance. Of the 120 tablets, $\frac{1}{6}$ th are laced with poison cyanide. In this scenario, do you consider $\frac{1}{6}$ th to be a large fraction?	90.5	(87.6-92.8)

**Figure 1: Percent (and 95% confidence interval<sup>51</sup>) of respondents answering “yes” to the question: “In this scenario, do you consider  $\frac{1}{6}$ th to be a large fraction?”**



These responses make one simple point clear: it is easy to invent hypothetical scenarios in which the vast majority of people will describe  $\frac{1}{6}$  as a large fraction. Indeed, we can rule out with great statistical confidence the possibility that less than a majority of people in the population from which

<sup>51</sup> 95% confidence interval shown as error bars.

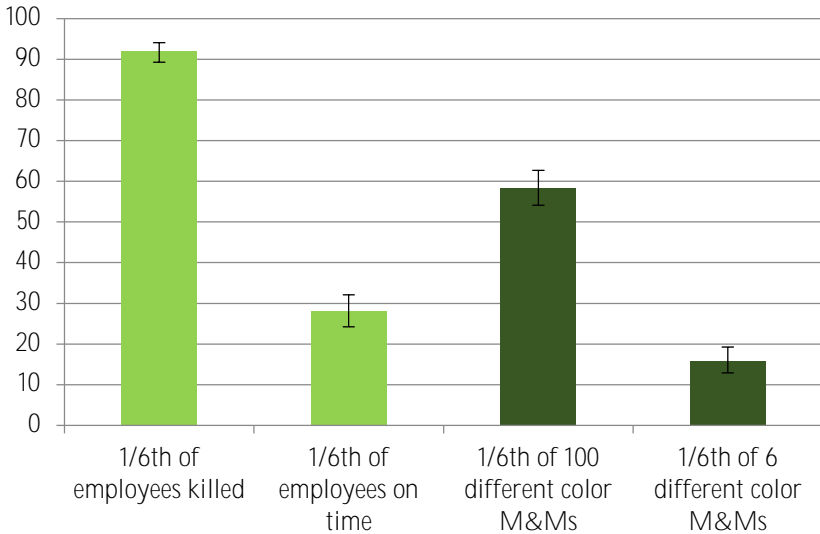
our sample was drawn view  $1/6$  as a large fraction in each scenario (McNemar exact  $P < 0.001$  in each case). Based on these two questions alone, we can say with confidence that, under common understandings of the terms,  $1/6$  can indeed be a large fraction and that the Fifth Circuit's use of the term does not reflect common patterns of English usage. The more flexible test used by the Eighth Circuit and the district courts in South Dakota and Indiana better captures the idea of a "large fraction."

We next tested the hypothesis that the percent of people who characterize  $1/6$  as a large fraction can vary substantially across different scenarios. To test this hypothesis, we used two pairs of questions that were randomly ordered for each respondent. These questions and the answers are in Table 2 below; the answers are also charted in Figure 2 below.

**Table 2: Percent (and 95% confidence interval) of respondents answering "yes" to the question: "In this scenario, do you consider  $1/6$ th to be a large fraction?"**

<b>Scenario</b>	<b>Percent</b>	<b>(95% CI)</b>
A local business has 120 employees working at its main office. One day, $1/6$ th of the employees are killed in separate individual car accidents.	92.0	(89.3-94.1)
A local business has 120 employees working at its main office. Everyone normally arrives on time. One day, $1/6$ th of the employees arrive on time.	28.0	(24.2-32.1)
A specialty package of M&Ms contains 600 M&Ms. There are 100 different colors in the package. You pour the M&Ms out of their package, sort them according to color, and find that $1/6$ th of the M&Ms are magenta.	58.4	(54.1-62.7)
A package of M&Ms candy contains 120 M&Ms. There are six different colors—blue, red, green, yellow, orange, and brown. You pour the M&Ms out of the package, sort them according to color, and find that $1/6$ th of the M&Ms are blue.	15.9	(12.9-19.3)

**Figure 2: Percent (and 95% confidence interval<sup>52</sup>) of respondents answering “yes” to the question: “In this scenario, do you consider  $\frac{1}{6}$ th to be a large fraction?”**



The results show substantial variation in how respondents characterize the fraction  $\frac{1}{6}$ . In fact, for both pairwise comparisons, we can reject with a high level of statistical confidence (McNemar exact  $P < 0.001$ ) the possibility that respondents are equally likely to describe  $\frac{1}{6}$  as a large fraction in the two scenarios. Thus, although our first set of questions shows that  $\frac{1}{6}$  can be a large fraction, it is not always so. In other words, the extent to which people regard  $\frac{1}{6}$  as a large fraction depends strongly on the context in which that fraction is presented.

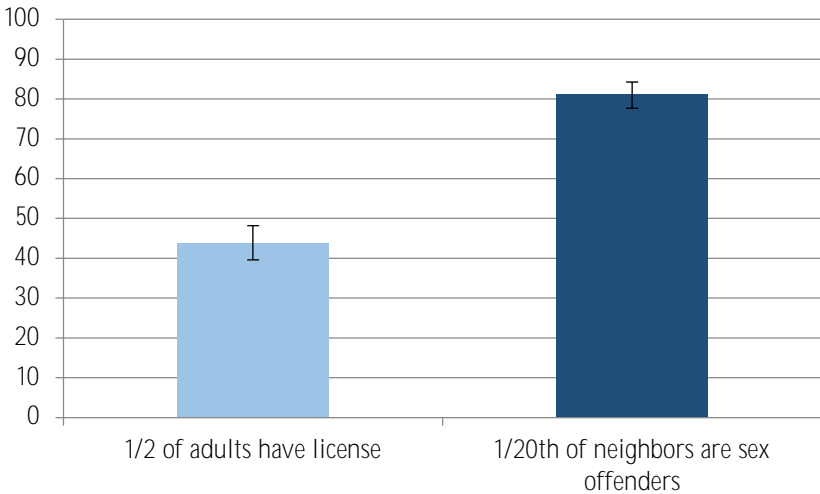
Our third hypothesis was that, given the right scenarios, fractions much larger than  $\frac{1}{6}$  can be considered small while fractions much smaller than  $\frac{1}{6}$  can be considered large. Table 3 presents the questions and answers exploring how people categorize the fractions  $\frac{1}{2}$  and  $\frac{1}{20}$  in different scenarios; the responses are also shown in Figure 3.

<sup>52</sup> 95% confidence interval shown as error bars.

Table 3: Percent (and 95% confidence interval) of respondents answering “yes” to the question.

Scenario	Percent	(95% CI)
Suppose you learn that, among all the adults living within 10 miles of your home, $\frac{1}{2}$ have a driver’s license. In this scenario, do you consider $\frac{1}{2}$ to be a large fraction?	43.8	(39.6-48.2)
Suppose you learn that, among all the adults living within 10 miles of your home, $\frac{1}{20}$ th are convicted sex offenders. In this scenario, do you consider $\frac{1}{20}$ th to be a large fraction?	81.1	(77.7-84.3)

Figure 3: Percent (and 95% confidence interval<sup>53</sup>) of respondents characterizing the group as a large fraction.



The answers show how strong the effect of the scenario can be on whether the fraction is considered large. Of course,  $\frac{1}{2}$  is ten times larger than  $\frac{1}{20}$ . Yet in these two scenarios, the vast majority of respondents characterized  $\frac{1}{20}$  as a large fraction, whereas a slight minority characterized  $\frac{1}{2}$  as a large fraction. The difference between these two percentages is highly statistically significant (McNemar exact  $P < 0.001$ ), indicating that the tendency of people

<sup>53</sup> 95% confidence interval shown as error bars.

to characterize a fraction as large can depend more heavily upon the scenario in which the fraction is presented than on the size of the fraction itself.

Our final hypothesis was that in politically-charged scenarios, respondents would varyingly characterize the fraction  $\frac{1}{6}$  as large or not depending on how the scenario aligned with their political views. We explored this possibility by presenting the fraction  $\frac{1}{6}$  to respondents in two politically charged scenarios, one involving legislation (like the Texas legislation) that would lead to the closing of abortion clinics, and the other involving legislation that would lead to the closing of gun stores. We examined how the tendency to describe  $\frac{1}{6}$  as a large fraction in each of these scenarios varied according to two indicators of political views: participants' reports of whom they voted for the last time they voted in a U.S. presidential election, and participants' ideological identification on a five point scale from very conservative to very liberal. The scenarios and results are presented in Table 4; the results are also shown graphically in Figure 4.

**Table 4: Percent (and 95% confidence interval) of respondents answering “yes” to the question: “In this scenario, do you consider  $1/6$ th to be a large fraction?”**

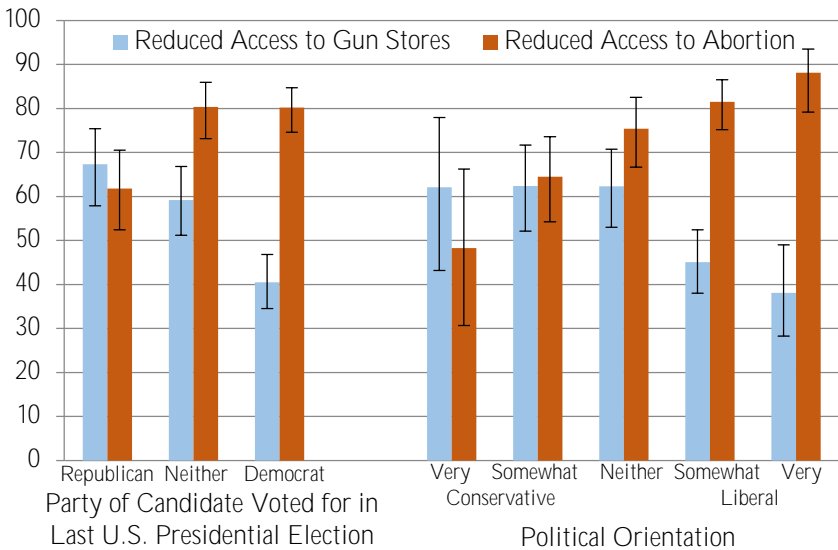
**Abortion Clinic Scenario:** A particular U.S. state with 6 million women of reproductive age enacts a law regulating the operation of abortion clinics. Some clinics are forced to close or stop providing abortions because they cannot afford to comply with the new regulations. As a result,  $1/6$ th of the women of reproductive age in that state would have to travel at least 150 miles to get to a clinic that still remains open.

<b>Respondent’s Voting Record</b>	<b>Percent</b>	<b>(95% CI)</b>
Republican Party’s Candidate	61.8	(52.4-70.5)
Neither Party’s Candidate	80.3	(73.1-85.9)
Democratic Party’s Candidate	80.2	(74.6-84.7)
<b>Respondent’s Political Orientation</b>	<b>Percent</b>	<b>(95% CI)</b>
Very Conservative	48.3	(30.7-66.2)
Somewhat Conservative	64.5	(54.2-73.6)
Neither Conservative nor Liberal	75.4	(66.7-82.5)
Somewhat Liberal	81.5	(75.2-86.5)
Very Liberal	88.1	(79.2-93.5)

**Gun Store Scenario:** A particular U.S. state with 6 million adult residents enacts a law regulating the operation of gun stores. Some stores are forced to close or stop selling guns because they cannot afford to comply with the new regulations. As a result,  $1/6$ th of adults in that state would have to travel at least 150 miles to get to a store that still sells guns.

<b>Respondent’s Voting Record</b>	<b>Percent</b>	<b>(95% CI)</b>
Republican Party’s Candidate	67.3	(57.9-75.4)
Neither Party’s Candidate	59.2	(51.2-66.8)
Democratic Party’s Candidate	40.5	(34.5-46.8)
<b>Respondent’s Political Orientation</b>	<b>Percent</b>	<b>(95% CI)</b>
Very Conservative	62.1	(43.2-77.9)
Somewhat Conservative	62.4	(52.1-71.7)
Neither Conservative nor Liberal	62.3	(53.0-70.7)
Somewhat Liberal	45.1	(38.0-52.4)
Very Liberal	38.1	(28.3-49.0)

**Figure 4: Percent (and 95% confidence interval) of respondents answering “yes” to the question: “In this scenario, do you consider 1/6th to be a large fraction?”**



Overall, 76.2% of respondents characterized 1/6 as a large fraction in the scenario involving abortion clinic closures. But this percentage varied markedly by both indicators of political views. Among respondents who said they voted for the Democratic Party’s candidate the last time they voted in a U.S. presidential election, 80.2% characterized 1/6 as a large fraction. In comparison, 61.8% of those who said they voted for the Republican Party’s candidate described 1/6 as a large fraction. This difference was statistically significant ( $Z = 3.60, P < 0.001$ ). Similarly, whereas 88.1% of respondents who described themselves as very liberal characterized 1/6th as a large fraction in this scenario, only 48.3% of those who described themselves as very conservative did so. Again, this was highly statistically significant ( $\chi^2(4) = 27.59, P < 0.001$ ).

The opposite pattern pertains to the scenario involving gun store closures. There, 52.0% of participants overall described 1/6 as a large fraction, but sharp political gradients were evident. Whereas 67.3% of respondents who said they voted for the Republican Party’s candidate described 1/6 as a large fraction in the gun store scenario, only 40.5% of those who voted for the Democratic Party’s candidate did so. Similarly, the percentage of respondents describing 1/6 as a large fraction in this scenario ranged from around 62% among those who characterized themselves as very conservative, conservative, or neither conservative nor liberal; to 38.1% among those who characterized themselves



as very liberal. As with the abortion clinic scenario, differences were highly statistically significant for both voting record ( $Z = 4.57, P < 0.001$ ) and self-reported political orientation ( $\chi^2(4) = 20.18, P < 0.001$ ).<sup>54</sup>

### III. IMPLICATIONS FOR THE SUPREME COURT

When the Supreme Court considers *Whole Woman's Health* this term, it should consider these lessons. The Court has never previously precisely defined a “large fraction,” so the everyday English understanding of the phrase matters. In this regard, our study conclusively demonstrates that the analysis from the Fifth Circuit on this point—that only a “vast majority” can count as a “large fraction” and that  $1/6$  “nowhere near” qualifies—was both inadequate and completely at odds with how the phrase functions in the English language.

At a minimum, the Supreme Court’s analysis must contend with the simple truth derived from the first conclusion of our study—in many situations  $1/6$  is indisputably a large fraction. The questions in Table 1 about lacing  $1/6$  of Tylenol pills with cyanide and forfeiting  $1/6$  of a salary provide compelling support for this conclusion. It takes very little imagination to think up more questions along this line. For instance, if a study revealed that  $1/6$  of the last 1000 Supreme Court cases had undisputed outcome-altering legal errors, or if a news report indicated that  $1/6$  of the world’s population had suddenly contracted the bubonic plague, we have no doubt the Justices would agree that  $1/6$  was a large fraction in both scenarios.

The Court’s analysis should also contend with the second and third conclusions from our study—that whether  $1/6$  is considered a large fraction depends on the scenario, and that in some contexts, fractions smaller than  $1/6$  are considered large while fractions much greater than  $1/6$  are considered not large. Taken together, these two results indicate that the driving factor for whether a fraction is considered large is the a priori expectation brought to a scenario. In other words, in scenarios where people expect the described circumstance to be extremely rare, they are likely to characterize  $1/6$  as a large fraction because it is large in relation to their expectations. Conversely, in scenarios where participants expect the described circumstance to be very common, they tend not to characterize  $1/6$  as a large fraction.

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<sup>54</sup> We tested four other politically charged scenarios regarding food stamps, gun permits, drug-testing welfare recipients, and corporate tax fraud. We do not include this data because either the results are mostly duplicative of the abortion clinic and gun store data (in the case of food stamps and gun permits) or the questions were poorly conceived because there are confounding variables within the politics of the issue that could push people on both ends of the political spectrum to view the baseline occurrence rate the same way (in the case of drug-testing welfare recipients and corporate tax fraud).

The two different questions about M&M candies in Table 2 make this clear. In one scenario, there are six different colors. An uncontroversial (though not necessarily true<sup>55</sup>) assumption would be that the colors are approximately evenly distributed, meaning roughly  $\frac{1}{6}$  of the 120 candies would be any one particular color. Because that is the baseline assumption, very few people characterized  $\frac{1}{6}$  as a large fraction when  $\frac{1}{6}$  of the candies were blue. However, when 100 different colors and 600 candies were present, the baseline assumption of even distribution would suggest that  $\frac{1}{100}$  (or 6) of the candies should be any particular color. When presented with a situation in which  $\frac{1}{6}$  (or 100) of the candies are magenta, a clear majority described  $\frac{1}{6}$  as a large fraction. The difference is obvious—in the first scenario, the expectation is met, so  $\frac{1}{6}$  is not considered large; in the second scenario, the expectation is far exceeded, so  $\frac{1}{6}$  is considered large.

The same analysis explains why the Justices might consider  $\frac{1}{6}$  to be large if  $\frac{1}{6}$  of their opinions had undisputed outcome-changing legal errors or if  $\frac{1}{6}$  of the people in the world contracted the plague. The expectations the Justices undoubtedly share are that there are zero, or very close to zero, undisputed outcome-changing legal errors in their cases and that zero, or very close to zero, people will wake up tomorrow with the plague. If they learned that  $\frac{1}{6}$  of their cases had such errors or that over a billion people had the plague who did not have it yesterday, because these numbers far exceed their expectations, they would be likely to characterize the fraction as large.

The findings here and their implications for the “large fraction” test are not new in the world of linguistics and semantics. To scholars of those disciplines, the word “large” is a relative gradable adjective. Relative gradable adjectives have no absolute measure and instead exhibit “contextual variability in truth conditions.”<sup>56</sup> This means that “large” has no clear content without having a comparative class by which to judge it.<sup>57</sup>

In this sense, “large” is like the oft-studied word “tall.” Everyone would describe Manute Bol, who was one of the tallest players to ever play in the NBA,<sup>58</sup> as tall. However, compared to the Empire State Building or Mt. Everest, he was not at all tall. The adjective “tall” still fits Bol, however, because the understood comparison class when describing him as tall does not

<sup>55</sup> See generally Joshua F. Madison, *M&M's Color Distribution Analysis*, JOSH MADISON (Dec. 2, 2007), <http://joshmadison.com/2007/12/02/mms-color-distribution-analysis/> [<https://perma.cc/2RFM-WM25>].

<sup>56</sup> See generally Christopher Kennedy, *Vagueness and Grammar: The Semantics of Relative and Absolute Gradable Adjectives*, 30 LINGUISTICS & PHIL. 1 (2007).

<sup>57</sup> See Peter Ludlow, *Implicit Comparison Classes*, 12 LINGUISTICS & PHIL. 519, 520 (1989) (specifically analyzing the adjective “large”).

<sup>58</sup> See Patrick McGeehan, *Manute Bol, N.B.A. Player and Activist, Dies at 47*, N.Y. TIMES (June 19, 2010), <http://www.nytimes.com/2010/06/20/sports/basketball/20bol.html> [<https://perma.cc/F9PD-EEK9>] (noting that Bol, who stood 7 feet, 6 inches tall, was only slightly shorter than Gheorge Muresan).

include skyscrapers or mountains—it includes other human beings, or even more narrowly but still accurately, other NBA players.

But “tall” is not reserved only for the tallest human beings. We could also call a two-year-old tall. If a two-year-old is 3 feet, 6 inches tall, which is well above the two-year-old mean of just under 3 feet,<sup>59</sup> almost everyone would describe her as tall, even though she is over 1,450 feet shorter than the tip of the Empire State Building,<sup>60</sup> over 29,025 feet shorter than Mt. Everest,<sup>61</sup> four feet shorter than Manute Bol,<sup>62</sup> and around 2 feet shorter than most adults.<sup>63</sup> The reason is that the assumed comparative class is not skyscrapers, mountains, NBA players, or adult human beings (or even all children). The understood comparison class is children of the same age. Thus, the 3 foot, 6 inch two-year old is tall while the 3 foot, 6 inch fifteen-year-old, NBA player, skyscraper, or mountain is not. Likewise, a much taller 4 foot, 10 inch adult is also not tall. In all of these scenarios, the a priori expectation is what determines the meaning.

When the Supreme Court Justices analyze whether  $1/6$  of Texas women of reproductive age who are facing an undue burden in obtaining abortion services is a “large fraction,” they must grapple with their a priori expectations about women facing burdens to accessing abortion. Is the expectation that all women have a constitutional right to access abortion services without facing a substantial obstacle? If so, then  $1/6$  is certainly a large fraction. Or is the expectation that it is perfectly constitutional for many, maybe half or even far more than half of women to face a substantial obstacle? If that is the case, then  $1/6$  is not a large fraction. Either way, our study, along with basic semantic understandings, indicates that the background assumption about the comparison class needs to be made explicit in order to properly analyze whether the fraction is large.

Finally, our study indicates that it is impossible to ignore that in some situations, people may also bring prescriptive expectations—a priori beliefs about what is right and wrong or just and unjust—to scenarios. When a fraction arises in a circumstance that people believe is unjust, they may be

59 See NAT'L CTR. FOR HEALTH STATISTICS, 2 TO 20 YEARS: GIRLS STATURE-FOR-AGE AND WEIGHT-FOR-AGE PERCENTILES (2000), <http://www.cdc.gov/growthcharts/data/setuclinical/cj41lo22.pdf> [<https://perma.cc/K24F-36HL>] (listing the average height of a two-year-old girl as about 2 feet, 10 inches).

60 See *Empire State Building Fast Facts*, CNN (Feb. 1, 2016), <http://www.cnn.com/2013/07/11/us/empire-state-building-fast-facts/> [<https://perma.cc/3MMJ-WP7N>] (1454 feet tall).

61 See *Height of Mount Everest*, ENCYCLOPEDIA BRITANNICA, <http://www.britannica.com/topic/height-1673089> [<https://perma.cc/96WT-X2TL>] (last updated Apr. 9, 2010) (29,035 feet tall).

62 See McGeehan, *supra* note 55 (noting that Bol is 7 feet, 6 inches tall).

63 See *Body Measurements*, CDC, <http://www.cdc.gov/nchs/fastats/body-measurements.htm> [<https://perma.cc/ZGR8-XK8S>] (last updated Nov. 2, 2010) (an average man is 5 feet, 9 inches tall, and an average woman is 5 feet, 4 inches tall).

more likely to characterize that fraction as large. This would explain why such a large percentage of respondents characterized  $\frac{1}{6}$  as a large fraction in response to the question about the employee being asked to donate that portion of his income to his boss's daughter's private school.

It follows that when individuals or groups differ systematically in their prescriptive expectations—their ideas about what is right and wrong, just and unjust—these differences may influence how likely they are to see a given fraction as large or not large in a scenario to which those expectations pertain. To the extent that prescriptive expectations align with people's political views, their views may be associated with the tendency to characterize fractions as large in politically-charged scenarios. Thus, political liberals were more likely to characterize  $\frac{1}{6}$  as a large fraction in the scenario involving the closing of abortion clinics, whereas political conservatives were more likely to characterize  $\frac{1}{6}$  as large in the scenario involving the closing of gun shops. These results align with the generally-understood differences between political liberals and conservatives on the issues of abortion and guns.

Given that *Whole Woman's Health* involves one of these exact issues—closing abortion clinics—the Justices need to be particularly careful. The Justices must avoid allowing their own political views on abortion to cloud their analysis of whether a large fraction of women are unduly burdened in this case, a concern that should be taken seriously after the Fifth Circuit's highly superficial analysis of the issue.

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