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Is Utah the Most Sexist State? No

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Abstract:
This paper critically examines the claim that Utah is "the most sexist state" in the United States, as suggested by a WalletHub report ranking it lowest in "Women's Equality." Utilizing an economic analysis from the Austrian School perspective, this study scrutinizes the data, metrics, and conclusions of reports by the Utah Women & Leadership Project (UWLP). The analysis focuses on distinguishing statistical disparities from sexism, proposing that observed gender inequalities in Utah are largely influenced by cultural and economic factors, particularly the state's high marriage rate and traditional gender roles. Contrary to the notion that sexism predominantly drives gender disparities, the paper argues that personal choices and subjective value theory play significant roles in shaping these outcomes. The study highlights the importance of considering cultural context, individual preferences, and the marital asymmetry hypothesis when interpreting gender-related data, challenging the assertion that Utah's gender disparities are primarily due to sexist attitudes. The findings suggest that Utah's gender gaps in areas such as income and workforce participation are more accurately attributed to the state's unique cultural and economic landscape rather than pervasive sexism.
Keywords: wage gap, sexism, marriage, discrimination.

1. Introduction

According to an August 2021 report on WalletHub, a website for personal finance, Utah was ranked as the lowest scoring state for "Women's Equality" (McCann 2021a). This has led to the claim that Utah is "the most sexist state" in the U.S. or "the worst state for women."[1] Referencing the WalletHub report, two papers were published by the Utah Women & Leadership Project— an organization whose mission is "to strengthen the impact of Utah girls and women."[2] The first of the papers is a "Research Snapshot" on the gender pay gap that was published in October (Winkel, et al 2021) while the second (Madsen & Madsen 2021) is a more thorough analysis of the statistical data regarding the disparities between men and women in areas such as the workplace and politics.

The present paper provides a critical economic analysis (particularly from an Austrian School perspective) of the data collected, the metrics used to measure sexism, and the conclusions made therein. It is important to note that the current work does not make claims about the organization's mission or the organization itself; rather the focus is on disputing the claim that Utah values men more than women to a greater degree than any other state.

In Section 2, we discuss Discrimination & Disparities. Section 3 is given over to demonstrating that metrics showing statistical inequalities do not necessitate sexism. The burden of Section 4 is to offer the marital asymmetry hypothesis. We conclude in Section 5.

2. Discrimination & Disparities

Most discussions surrounding oppression, sexism, racism, and many other forms of discrimination are centered around statistical disparities. The claim is oftentimes something like "because group X doesn't make the same amount as group Y, we must conclude it is because of prejudice and discrimination." In order to measure whether members of a particular group are experiencing "unfair" treatment or being excluded from certain outcomes solely based on factors they have no control over, e.g., sex, race, or disabilities, we must define such prejudicial behavior.

For example, discrimination in and of itself is not a bad thing. In his book *Discrimination and Disparities*, economist Dr. Thomas Sowell (2018, p.30) illustrates different types of discrimination, "an ability to discern differences in the qualities of people and things, and choosing accordingly" (Discrimination I) and the "narrower, but more commonly used, meaning — treating people negatively, based on arbitrary aversions or animosities to individuals of a particular race or sex" (Discrimination II). The first of these definitions is an innocent form of preference that we demonstrate on a daily basis for things like food or entertainment.

Sowell's central thesis is that the existence of statistical disparities between certain groups does not necessitate the existence of Discrimination II, i.e., prejudice based on *external factors* such as skin color or sex. The NBA is overwhelmingly dominated by African American men,[3] nevertheless it would be absurd for anybody to claim that the NBA is racist against White and Hispanic men; furthermore, it would be even more ridiculous for the NBA to try and equalize the demographics so that each race is represented "fairly" or equally.

There is no dispute here regarding the existence of certain disparities such as gender pay gaps or female- vs male-owned businesses. However, we cannot conclude that these inequalities are the result of overwhelming numbers of male Utahns holding sexist views against female Utahns. There must be evidence and data behind those numbers proving that the present outcomes are a result of discrimination based on *external factors*. In this paper we will define "sexism" as the prejudice against

one group solely based on their sex while discounting such *internal factors* such as economic productivity, knowledge, experience, etc.

Culture and Economics: The Key Role of Subjective Value Theory

There exist several different competing economic theories which explain what determines the value of a good. It is our view that the correct theory was that of the Austrian School: all values are subjective and are imputed from the mind of the consumer or economic actor. Subjective value theory comes from the basic economic axiom that humans use different means to achieve specific ends. It is the desire to achieve those ends that then determines the value of certain means for the economic actor. These subjective preferences ultimately determine the economic structure of different societies. For example, meat eaters purchase meat because they value its consumption. Vegetarians will not pay anything for meat because they place higher value on the life of animals. A society predominantly made up of vegetarians would likely end up making the few meat eaters pay higher premiums for meat because the capital equipment for production would likely be tied up in more vegetarian friendly products.

This helps us understand why claims on what is objectively good or objectively bad can become problematic. We cannot easily determine good and bad unless we have some sort of preferred outcome to measure against, e.g., if individual liberty is of high value in society, then any actions that infringe on individual rights and use coercion will be labeled as bad. Subjective value theory is critical in understanding cultural and economic issues because it is the subjective preferences of a community that will determine specific outcomes.

Since its settlement, Utah's population has overwhelmingly been made up of religious people, mostly Mormons. The most central tenet of the Mormon faith is family[4]. It is only logical then that communities in Utah would structure their economic system around families. An expected outcome in such a culture would be high levels of childbirth — seeing that pregnancy is exclusive to women, we can most certainly expect to see unequal levels of workforce participation and labor productivity between men and women. Where incomes are determined by labor productivity, we can also anticipate that men will tend to have higher levels of income since mothers suffer a gap in their years of experience and tend to have more unpaid hours of labor (e.g., being a mom) than men. Note that we are not saying the value of women is based on their ability to be mothers but rather analyzing the unequal affect that motherhood and childbirth have on women compared to men in the business world, where wages are paid. Nor does income represent the inherent value of a person, but rather it tends to indicate the value of one's labor in economic exchange.

During the last quarter of 2021, the Utah Women & Leadership Project published two papers: *Utah Gender Wage Gap: A 2021 Update* (Winkel, et al 2021) and *Women's Equality in Utah: Why Utah Is Ranked as the Worst State, and What Can Be Done* (Madsen & Madsen 2021). These papers refer to studies and data reported by WalletHub, the Salt Lake Tribune in collaboration with Suffolk University, and the UWLP's own recalculation on WalletHub's study.

In the paper by Winkel, the "Research Snapshot" focuses on the gender pay gap exclusively. This paper refers to data gathered by the SLC Tribune and Suffolk University which surveyed 400 women in Utah[5]. In reviewing the questions found on the survey, there were several that stuck out as questionable regarding their reliability in determining sexism as the culprit behind gender disparity. For example, the question, "Generally, do you feel Utah is headed in the right direction or is on the wrong track?" doesn't specify what is "the right direction" or the "wrong track". Lacking this context, it is hard to understand what exactly is meant when 63% vote "right direction". Other questions seemed to be contradictory in that when thinking about all of female Utahns, women said they believed they were to some degree at a lower status than men or that their biggest challenge was "cultural expectations

about gender roles"; however, when asked about their own personal experiences, over 70% of women said that they felt that their support networks (family, friends, faith, etc.) were strongly supportive of their aspirations for their careers and higher educational goals. Additionally, over 70% said they felt they were reaching or had attained their educational goals.

It is more important to take into consideration the personal experiences of these women versus their perceptions of what they think others are going through — and in this case it doesn't seem accurate to say that the larger perception held by these women matches up with their collective personal experiences. When it comes to working hours, only 183 identified as having worked part-time in the past 10 years and the highest scores explaining why were between being at home with family or to make additional income.

Furthermore, 50% of those 183 said they *did not prefer* working full-time. Full-time versus part-time is one of the key factors behind the disparity between men and women. Accusations of sexism are completely baseless when women are voluntarily choosing to work less than men.

When you split the survey between actual personal preference along with experience against perceptions of the larger group and things they would like to see, the results tell different stories. Despite the belief that women as a whole in Utah experience lower status and discrimination, they themselves report having received strong support from their networks for their decisions. Of those who were working part-time, half said they preferred part-time to full-time. As Dr. Thomas Sowell has pointed out all through his career, statistical disparities without knowledge behind the data mean nothing; therefore, any conclusions relying solely on disparate outcomes are meaningless.

Winkel and her colleagues make several important concessions in their research regarding some of the most important factors behind the pay gap: "The gender wage gap decreases when controlling for factors such as age, education, and job selection, yet recent studies have shown a remaining 2% to 8% gender wage gap." (p.1) What makes this extremely significant is that the paper opens by saying that Utah women earn 30% less than men. After controlling for said variables, the gap shrinks anywhere from 73% to 93%. In other words, the UWLP's own research shows that women's age and personal choices regarding work alone almost completely close the wage gap. Assuming that the remaining 2% to 8% can be explained conclusively as sexism, that would mean it's role only plays from 7% to 27%[6] of the total gap. However, the reality is that there still exist other factors that are hard to measure that could explain the remaining gap. For example, one of the most well-known personality differences between men and women in the workplace is that women tend to be more agreeable, a trait that typically leads to lower wages.

Highlighting the economic factors at play is important in dissecting whether disparate outcomes are consequences of gender discrimination or personal decisions. What we can see thus far is that the reality aligns more with the latter. However, the UWLP is aware of this. Consequently, they then shift the blame from what most people would interpret as sexism to the fault of sexist cultural and social norms. This argument thus moves away from the standard thought that women are excluded from higher incomes or leadership roles because they are women, and towards the idea that women have "internalized"[7] sexist attitudes against themselves. This is a bizarre claim to say the least. How would one measure the level of internalized sexism? Researchers would have to prove that, despite a woman's personal preference to become a mother or work fewer hours, she is not choosing to do so because of her own autonomy, but rather because she was brainwashed into doing so via culture.[8] Other metrics that could prove useful might look at data from women who regret having had children as well as women who are sad because they never became mothers.

3. Metrics Showing Statistical Inequalities Do Not Necessitate Sexism

The most recent report published by the UWLP (Madsen & Madsen 2021) was a white paper commissioned by Zion's Bank released at the beginning of December 2021. Using WalletHub's data, the authors of this study recalculated the 17 metrics that WalletHub used "to ascertain where women receive the most equal treatment". (p.1, 4) One of the sources of data that is referenced comes from a national questionnaire put out by "economists from the University of Chicago, Northwestern University, and National University of Singapore" (p.1) in which participants were asked questions to measure sexist attitudes. As demonstrated in earlier sections of the present paper, questionnaires like these can be tricky, biased, or even interpreted in a myriad of ways. Despite attempts to find the questionnaire published by these universities, only references to the study came up — not the study itself. This makes it difficult to know what questions were asked and how they were measuring them against sexist attitudes. Were answers that upheld more traditional family roles labeled as more sexist? If so, is it then accurate to say that holding a belief in different family responsibilities is sexist? The UWLP paper also reiterates the notion that internalized sexism is a major factor in Utah's gender disparities. (p. 1)

Before going into its findings, the white paper makes several important concessions that don't appear to receive as much credit as they are due. For example, it is acknowledged that the members of the Church of Jesus Christ of Latter-day Saints make up 60% of the population and therefore outcomes will be heavily influenced by this fact,

> The Latter-day Saint Church emphasizes family formation, and, while recognizing equality between partners in marriage, it also emphasizes that genders have different roles—men and fathers to provide and protect, and women and mothers to nurture and teach their children. This division of effort and focus continues to influence the labor force decisions of many Utah residents and most likely impacts how Utah scores on several of the metrics measured in the WalletHub survey… (p. 3)

Holding the belief that there exist gender roles or responsibilities within a family does not necessitate the existence of sexism or the belief that one gender is above the other. In fact, it isn't doctrine within the church that men must always and only be the providers and women the caregivers. Plenty of non-traditional families can be found within the faith and are not excluded or punished for mothers taking on the responsibility of provider and fathers of caregiver. The Church's encouragement of gender roles can easily be described as the division of labor — a central law of economics that describes the importance of human cooperation in society to bring about greater productivity.

The UWLP also points out that the WalletHub ranking system "may not include other potential equality metrics that could shed a more positive light on Utah women's contributions in various domains, including the home and community." (p. 3) Leaving out important statistics that would serve to defend Utah's status as an "equal" state for women is biased when the ultimate conclusions given by these reports are that Utah is the worst in this regard. Moreover, it is also conceded that in another report by WalletHub from the same year, "The Best and Worst States for Women" (McCann, 2021b) the Beehive state ranks significantly higher: "Utah ranks much better—28th. This ranking includes women's economic and social wellbeing (Utah=32) and women's health and safety (Utah=24)." (Madsen & Madsen, p. 3, 2021).

In fact, according to the women's equality survey, Nevada is ranked number one and Utah is dead last, while in the survey highlighting the best states for women, Utah not only jumps up to number 28, Nevada drops to the 44th spot out of 50. The question then arises: why is the state that is alleged to

be the most equal one of the worst for women generally hopping around so radically? And how would Utah, ranking the worst for "equality", rank significantly higher for women generally? What is the relationship between "equality" as defined by the UWLP and the best place to live altogether for women?

It is also worth highlighting that another severely overlooked weakness to the WalletHub survey is that "The report's author explained that for certain metrics—where women showed an advantage over men—they treated the state as having gender equality." (Madsen & Madsen, p.4 2021). This is another metric that, being discounted, allows for a desired outcome rather than accurate reporting. Again, while these factors are mentioned by the white paper, they are highly disregarded seeing that the report's conclusion is that Utah is terribly sexist.

In analyzing the 17 key indicators that WalletHub used, we argue, regardless of their statistical outcomes, they do not serve to determine whether Utah has a sexism problem or not. Disparities in indicators like income (#1, #2)[9], entrepreneurship rate (#6), average working hours (#7), or share of representative seats (#14-17) do not indicate any level of sexism whatsoever. Furthermore, providing recommendations to close these gaps while ignoring the reasons they exist is also inappropriate. For example, a significant portion of the income disparity between men and women can be explained by total working hours in full-time positions. The data shows that women working full-time average about 33.3 hours per week while men average 40.5 hours per week. (Madsen & Madsen, p.10 2021.) The UWLP once again admits that this particular indicator actually disadvantages men instead women and therefore, is discounted by WalletHub. The UWLP then recommends that, to close this gender wage gap,

> women need to increase their paid working time per week by 26 minutes. Each hour's increase in weekly employment beyond that would decrease the discrepancy by almost 2.5% and would increase Utah's total by 0.63 points… If women are to increase their hours doing paid work, it should be balanced by a complementary increase in the unpaid work performed by men, which would reduce the likelihood of women experiencing overwork and burnout. (p. 10)

The implications of such actions would mean that, for the sake of simply closing the gap, women need to spend more time working, even though a significant portion of them may prefer working less. Additionally, assuming a household with the average incomes of a man and a woman in Utah according to the Madsen & Madsen white paper[10], even though the husband has a higher marginal income, the wife — for the sake of gender equality — should work more paid hours while the husband works more unpaid hours. Never mind that this would decrease the total household income as well as the family budget; the focus here is on statistical parity between genders. To make matters worse, the white paper also advises raising the minimum wage by $2.00 in order to address the total annual income gap. This flies in the face of basic economics: raising the price floor does not solve issues like poverty or low wages. It simply makes employees more expensive to hire and leads to higher levels of unemployment than there otherwise would have been.[11]

4. The Marital Asymmetry Hypothesis

Let us contemplate one last statistical consideration, the marital asymmetry hypothesis. Utah has the highest marriage rage of all states in the union.[12] Here are the ten most heavily married states:

Utah	55.80%
Idaho	54.90%
Wyoming	54.30%
Nebraska	52.70%
North Dakota	52.40%
Kansas	52.20%
Montana	52.00%
Iowa	51.90%
New Hampshire	51.80%
Minnesota	51.70%

Here are the least heavily married ones:

California	46.80%
Georgia	46.80%
Mass.	46.60%
Florida	46.50%
Nevada	45.70%
New York	45.20%
Mississippi	45.00%
Rhode Is	44.60%
New Mex	43.90%
Louisiana	43.70%
DC	29.10%

Why should this even be of any relevance to our considerations? That is because marriage, alone, is one of the most powerful explanations of the male female wage gap compared to pretty much all of the other elements, such as full time versus part time, danger of the occupation, needed preparation, schooling, etc. How so? Marriage elevates the husband's compensation and reduces that of the wifes'. Why? This is because she does the lion's share of the cooking, cleaning, shopping, child care, chauffeuring, not only for the children, but for her partner as well. She in effect assists him in earning his greater income, while decreasing her own. Why? This is due to specialization and the division of labor, and the doctrine of alternative or opportunity costs: whenever you do anything, you do it at the cost of being able to do other things less well. If you specialize in playing the cello, like Yo Yo Ma, your time in the 100-meter dash will suffer. If you engage in the latter pursuit, like Usain Bolt, you are unlikely, also, to be a world-class cellist. When women focus on child care and household duties, they do so at the cost of reducing their productivity in the business world, and, hence, their salaries. The more marriages in a state, hence, the greater the pay gap.

There are two considerations to take into account in seeing the truth of these contentions. The pay gap between never married men and women, those not widowed, divorced, separated, or in any way connected to marriage, is virtually zero. Whereas in the case of the ever marrieds, alone, the gap is far larger than that of all males and females. Second, if men and women really had the same discounted marginal revenue productivity, and yet were paid differently, even slightly, there would be market forces brought to bear to correct any such disequilibrium imbalance. For the employer would earn more profit from hiring females than males. The relative remuneration of the former would rise that of the latter would fall, until in equilibrium, the gap would disappear. Also, under these assumptions, profits would be greater in industries which hired women than men; this cannot long endure, and capital

transfers would be from low to high profit areas of the economy. This, too, would increase female, and reduce male, earnings.

Of course, Utah, the, or one of the most heavily married states, would be expected, then, to have a relatively large gap between male and female incomes. But this is due not to sexism; rather, it is a result of the asymmetrical effects of marriage on male and female pay and thus the larger gap between them.[13]

5. Conclusion

When WalletHub and the Utah Women & Leadership Project published their reports on sexism, they demonstrated that there exist different levels of statistical disparity between men and women; however, they did not prove that sexism or gender discrimination was the culprit behind these inequalities. In fact, plenty of the data provided by these reports showed the opposite of prejudice against women: survey participants said they felt very supported in their educational and occupational decisions/goals; a significant amount also said they prefer working part-time over full-time; and the reports themselves admit that the gender wage gap closes significantly when controlling for other factors that aren't related to sexism. Furthermore, WalletHub's other survey on which states are best for women revealed that Utah is actually not the worst state and ranks significantly higher than Nevada, the state ranked #1 for women's equality. What the data about Utah reveals is that the beehive state is still greatly influenced by faith and family. Because these cultural norms lean more towards traditional gender roles, it is expected that there will be differences in areas like paid working hours or annual incomes between men and women. Nevertheless, this does not prove that sexism is the major factor behind gender inequality in Utah. There is no data showing that women are being held back or discriminated against simply because of their gender and nothing else.

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Notes

1. See (Raymond, 2021), (Pugmire, 2021), (Cortez, 2021).
2. See (Utah State University, 2021).
3. African-American men made up an average of 75.6% of the NBA demographic between 2010-2020 according to Statista, 2021.
4. See (The Church of Jesus Christ of Latter-day Saints, 2021).
5. See (Suffolk University, 2019).
6. 2/30 = .066; 8/30 = .266
7. See (Madsen, 2021), (Alberty & Ingraham, 2018).
8. Additionally, the fact that social media and the internet have dramatically increased the individual's ability to see outside their own culture makes it harder to believe that this is really the case.
9. These are references to the cardinal order of the 17 key indicators.
10. Women annually earn an average of $39,784 while men earn $57,117.
11. See on this (Batemarco, et. al. 2014), (Becker, 1995), (Block, 2001), (Burkhauser, Couch, Wittenburg, 1996), (Cappelli and Block, 2012), (Deere, Murphy and Welch, 1995), (Friedman, undated), (Gallaway and Adie, 1995), (Galles, 2014), (Gitis, 2014), (Hamermesh and Welch, 1995), (Hanke, 2014A, 2014B), (Hazlitt, 1946), (Hovenga, Naik and Block, 2013), (Howland, 2013), (Klein and Dompe, 2007), (Leef, 2021), (Lingenfelter et. al., 2017), (McCormick and Block, 2000), (Mincer, 1976), (Neumark, 2015), (Neumark and Wascher, 1992, 1995, 1998, 2000), (North, 2014), (Powell, 2013), (Reisman, 2014), (Rothbard, 1988), (Rustici, 1985), (Sowell, 1995), (Williams, 1982).
12. See (World Population Review, 2023). According to the National Vital Statistics System (2022) Utah takes second place to Montana in his regard.
13. (Becker, 1971, 1983, 1993), (Block, 2014), (Block and Walker, 1985), (Block and Williams, 1981), (Dubner, 2016), (Hoff-Summers, 2017), (Lehmann, 2018), (Levin, 1987), (Lukas, 2011), (Marcus, 2020), (McGee, 2017), (Mincer and Polachek, 1974), (Mortell, 2022), (Perry, 2014), (Sandel and Loury, 2020), (Sowell, 1982), (Woods, 2017). For an alternative view, see (Sayers, 2012).

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Feminist Film Theory: The Impact of Female Representation in Modern Movies

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Abstract:
In contemporary American cinema, the representation of women remains disproportionately limited despite significant social movements advocating for diversity and equality. This study examines the depiction of women in top-grossing films of 2018, contrasting those directed by men with those directed by women, to understand the influence of gender dynamics on cinematic portrayal. Analyzing the top five highest-grossing live-action movies directed by each gender, this research utilizes critical mass and critical actor theories to evaluate the impact of female filmmakers on the representation of women both on and off-screen. Findings reveal that films directed by women feature higher percentages of female characters and crew members in key roles, yet face substantial budgetary and box office disparities compared to their male-directed counterparts. Despite some progress, the film industry continues to exhibit systemic biases, necessitating further structural changes to achieve genuine gender equality in cinematic storytelling. This study underscores the need for increased opportunities and resources for female filmmakers to foster a more inclusive and diverse cinematic landscape.
Keywords: modern women in film, gender representation, female roles in cinema, film industry inequality, women in filmmaking, women's narratives in film, women's representation, gender equality in film.

1. Introduction

In the ever-evolving landscape of 21st-century media, motion pictures maintain a significant presence within American popular culture (Simonton, 2004). Despite shifts in consumption methods, cinema continues to draw millions of viewers to theatres annually, with the U.S. domestic box office grossing a substantial $10.7 billion in 2018 (Statista, n.d.). Concurrently, the annual Academy Awards, renowned as the pinnacle of cinematic recognition, garners considerable attention from audiences worldwide. The enduring prevalence of film in popular culture underscores its pivotal role as a cornerstone of American society and cultural expression.

However, even in contemporary times, the representation of various demographic groups within film remains disproportionate (Milburn, Mather, & Conrad, 2000). Such inadequacies in

cinematic representation, both on and off screen, have spurred numerous social movements in recent years, exemplified by initiatives like the #OscarsSoWhite campaign. This movement, which highlighted the lack of racial diversity among Oscars nominees, prompted the Academy of Motion Picture Arts and Sciences to pledge to "double the number of women and people of colour in the Academy's membership by 2020" (Reign, n.d.). Similarly, the #MeToo and "Time's Up" movements have sought to raise awareness and advocate for sexual assault victims, particularly women. Despite these social initiatives, the film industry as a whole, including the Academy of Motion Picture Arts and Sciences, continues to fall short in adequately representing women both on and off screen. Stereotypical portrayals and the scarcity of multifaceted female roles persist as common features within Hollywood and the broader media landscape.

The ramifications of these negative depictions extend beyond mere entertainment, resonating deeply within societal attitudes and cultural norms. Given the pervasive influence of film within popular culture and society, motion pictures often mirror prevailing cultural attitudes regarding gender roles, norms, and expectations (Simonton, 2004). Similarly, representations of minority groups within film and media can significantly shape the dissemination of stereotypes (Bazzini, McIntosh, Smith, Cook, & Harris, 1997). This reciprocal cause-and-effect dynamic perpetuates a cycle wherein societal stereotypes influence predominantly male filmmakers, who in turn produce art that reinforces these stereotypes (Simonton, 2004). While this cycle does not singularly account for all forms of misrepresentation within media, it remains a crucial consideration when evaluating portrayals of minorities in film.

Despite some strides in recent years, the progress in representing women within film has been tempered by persisting disparities. For instance, there has only been a modest 3% increase in female employment in the top 250 highest-grossing films since 1998 (Lauzen, 2018b). The dearth of substantial progress is particularly conspicuous in the nominations and awards of the Academy Awards, where only one woman has ever been awarded "Best Director" in the awards' 91-year history. In 2019, amidst societal shifts catalyzed by the #MeToo movement, no female directors were nominated for "Best Director," nor were any female directors nominated for "Best Picture." Furthermore, each of the top 30 highest-grossing movies in the U.S. in 2018 was directed by men (Box Office Mojo, n.d.).

In light of these observations, this paper seeks to delve deeper into the portrayal of women in popular film and the impact of behind-the-scenes representation on these depictions. Specifically, an analysis will be conducted on the top five highest-grossing live-action movies directed by men and the top five highest-grossing live-action movies directed by women in 2018. Through this examination, a more comprehensive understanding of the representation of women in popular cinema and the influence of gender dynamics within the film industry will be elucidated.

2. Literature Review

This literature review focuses on the current representation of women in Hollywood, critical mass theory and critical actor theory, as well as a discussion of male and female stories, all of which seek to analyze how women's roles in the film industry affect their representation on screen.

Current Representation in the Film Industry

A vast pool of prior research, empirical and otherwise, proves the existence of sexual discrimination in Hollywood. The term "actress" itself is laden with subtle sexism, as the suffix "-ess" implies that the roles of actor and actress differ as performed by men and women (Simonton, 2004). While not intentionally malicious, this small difference points to inherent discrimination in the film industry. Discrimination theory bases itself upon the idea that "members of a certain group are preferred, even when the work of these group members is indistinguishable from that belonging to another

group" (Lauzen, 2012b, 311). By differentiating, and seemingly preferring, male actors from female actors, the film industry shows its discriminatory tendencies.

By employing these tendencies, the film industry discourages women from entering the field and thus influences decisions to hire male workers instead of female workers (Lauzen, 2012b). "This has led inevitably to a situation in which the films… are most often written, directed, and produced by men" (Orwin, 2002, 271). This is evident by the vast amount of quantitative research conducted on employment in the film industry. In 2018, women accounted for only eight percent of directors at the helm of the top-250 grossing films in the United States, down one percent from 1998 (Lauzen, 2018b). Additionally, one in four films employed either zero women or one woman in the roles of director, writer, producer, executive producer, editor, and cinematographer. Only one percent of films employed ten or more women in those roles, compared to 74 percent of films employing ten or more men (Lauzen, 2018b).

In addition to this lack of proportionality, "the cultural devaluation of women is reinforced by the fact that they do not receive star billing as often as men" (Lincoln & Allen, 2004). According to Lauzen's "It's a Man's (Celluloid) World" report, only 36 percent of all major characters in 2018's top-100 grossing movies were women (Lauzen, 2018a). While that number is up nine percent from 2002, female stars appear in far fewer films than their male counterparts and thus infrequently become movie stars (Lincoln & Allen, 2004). In this way, films inherently tell audiences that "men are more important, in all kinds of contexts, than women" (Lincoln & Allen, 2004).

These issues have a clear solution: give female filmmakers more, and equal, opportunities. When women are hired as directors and writers, more female characters are employed (Sutherland & Feltey, 2017). "In films with at least one female director and/or writer, women comprised 43 percent of all speaking characters," a number much more proportionate to the U.S. population than the 32 percent of female speaking characters present in films with exclusively male directors and writers (Lauzen, 2018a). This disparity shows the effect that employing female filmmakers has on gender representation. However, female filmmakers tend to face far more unjust criticism than men when they are given positions (Kennedy, 2010).

One of the most prominent of these criticisms is the idea that female filmmakers present more of a financial risk than male filmmakers. When faced with large budgets, studio executives tend to fall back on directors who have had box-office hits in the past (Lauzen, 2012b). These directors are often male. This presents a bit of a paradox in which women are not hired for positions that require them to have previous jobs to prove their worth.

In reality, films that employ at least one female director, executive producer, producer, and/or writer garner approximately the same domestic box office sales as do films with exclusively male representation in those roles (Lauzen, 2008). Despite this, women are rarely afforded the same resources and budgets as men. This can partially be attributed to the emergence of the superhero genre—generally the highest-grossing movies in modern day Hollywood. Since the mid-2000s, when these films became widely popular, the genre has been dominated by male directors. Until 2017's Wonder Woman, directed by Patty Jenkins, no woman had directed a movie released by Marvel or DC, the two preeminent comic book studios in the film industry. While this trend seems to be changing with the upcoming releases of Cathy Yan's Birds of Prey, Patty Jenkins' sequel to Wonder Woman, Cate Shortland's Black Widow, and Chloé Zhao's The Eternals, the lucrative, high-budget genre has largely benefited men, leaving women to contend with small budgets and less box office influence.

In 2018, these superhero movies and other "action" films accounted for 34 percent of the year's box office gross (The Numbers, 2018). Additionally, all nine superhero movies released in 2018 were directed by men. This disparity present in the superhero genre alone can partially explain why films directed by women do not have budgets as large as movies directed by their male counterparts. While the sample size is small, women have succeeded at the box office when placed at the helm of big budget superhero films. Both Wonder Woman and Captain Marvel, the only two

modern superhero movies directed by women, have grossed over $800 million, with budgets over $120 million.

The disparity between gender representation in the director's chair also carries over to the Academy Awards. The Oscars hold a great deal of importance in the film industry. On the surface, it appears as though women are granted the same number of awards, with one Oscar for best actor and one Oscar for best actress, as an example. Yet women are rarely, if ever, nominated for other awards – only one woman has won "Best Director" in the 91-year history of the Academy. Outside of "Best Actress" and "Best Actress in a Supporting Role," only 15 women earned nominations out of a total 107 nominees in 2015 (McCarthy, 2015). This issue is compounded when considering the makeup of the Academy. In 2018, 69% of voters in the Academy were male (Statista, 2018). This number is down from 77% in 2015, partially in response to the #OscarsSoWhite movement. Even still, the lack of representation in the awards and in the Academy has serious repercussions. With men winning most of the awards at the film industry's most prestigious ceremony, the Academy places more importance on male filmmakers, thus granting them more opportunity.

Critical Mass and Critical Actor Theories

Mass social movements such as #OscarsSoWhite and #MeToo have begun to shed light on this issue. In addition, a number of prominent figures in Hollywood have pushed for "inclusion riders," or stipulations included in contracts that guarantee a certain level of gender diversity on set (Dwyer, n.d.). Even still, progress has been slow. To add to that, very little academic research has been done regarding possible solutions to gender inequality in the industry. Because of this, this literature review examines two gender equality theories prominent in politics and applies them to film. These theories do not intend to be all-encompassing solutions to gender representation, but seek to shed light on how roles behind the scenes can influence portrayals on screen. Feminism can be defined as a belief system advocating that women suffer discrimination due to their sex, have specific needs that are currently unmet, and that addressing these needs necessitates a significant transformation (potentially even a revolution) in the social, economic, and political structures. However, beyond this foundational agreement, the discourse becomes considerably more complex.

Referring to an irreversible turning point, critical mass theory states that representation in film is dependent on numeric designation. Some scholars in this area suggest a certain proportion of representation – perhaps 30% – is necessary before a minority group can see real change within the film industry (Dahlerup, 2006). According to the theory, a considerable minority is much more likely to make an impact than a few token individuals (Childs & Krook, 2009). Once a critical mass has been achieved, women will theoretically be able to push for substantial changes and legislation. In addition, a greater focus on feminist issues can result in men and women in the industry paying more attention to women's issues (Childs & Krook, 2006).

Critical mass theory has its weaknesses. It does not account for institutional pressures that may compel women to conform to masculine practices (Childs & Krook, 2009). Essentially, increased numbers of women in the film industry may facilitate coalitions, but sheer numbers do not guarantee equal on-screen representation, as women are not guaranteed to represent other women in gender issues.

This complication of the critical mass theory can be seen in Academy Award-winning director Kathryn Bigelow. Despite becoming the first and only woman to win an Oscar for "Best Director" for her 2008 film The Hurt Locker, Bigelow has been extremely resistant to discuss gender politics in the industry (Lauzen, 2011). Unlike many women in Hollywood, she made her name directing and producing action and war films such as Point Break and Zero Dark Thirty. In essence, Bigelow attempted to fit into the "male-dominated business of film directing by distancing herself from gender issues, while simultaneously aligning herself with traditionally male-identified traits, including toughness and the desire for control" through her tough on-set attitude and intense subject matter (Lauzen, 2011, 147). Bigelow's position and refusal to address inequality and gender

politics in Hollywood show the inadequacies of critical mass, as not every individual in a group is willing to advocate for change (Lauzen, 2012a).

Critical Actor theory, on the other hand, suggests a different solution to gender inequality in the industry. The theory rebukes critical mass, citing that individuals, not the mass, bring about change. Essentially, change depends on the acts of individuals within minority groups. According to the theory, critical actors are those who push forth change and inspire others to join in. Critical actors do not need to be a part of the minority group, with men playing a crucial role in the advancement of equality (Childs & Krook, 2009).

These two theories will be used to filter this study's analysis of the films at hand, considering both the number and agency of women in each film analyzed. With five of the films helmed by men and five of the films led by women, critical mass and critical actor theories will be used to evaluate how, and if, these filmmakers address inequality and promote feminist issues, and whether or not the mass or the individual most contributes to these causes.

Male Versus Female Stories

Female narratives frequently delve into themes of identity, relationships, and personal development, while often confronting conventional gender roles and stereotypes. These narratives resist patriarchal norms and the common sexist representations of women in mainstream media, which typically perpetuate traditional depictions of women as passive, nurturing, or subordinate to male characters. By diversifying the range of stories presented, feminist films not only offer a platform for diverse female experiences but also critically examine and dismantle the sexist and patriarchal foundations inherent in traditional storytelling. The inadequacies of Critical Mass theory suggest the need for women in Hollywood goes far beyond simple representation. Diversity in filmmaking also diversifies the type of stories told. Typically, women tell inward stories, in contrast to the very outward, masculine hero's journey (Orwin, 2002). While it is important for women to be able to tell a varied degree of stories, feminist films "explicitly or implicitly challenge, rather than subscribe to, dominant representations of female identity," thus differentiating itself from traditionally masculine films (Hankin, 2007, 60).

While men can, and sometimes do, tell female stories successfully, they often fail to empower women. Male filmmakers who are perceived to be unbiased still fail to tell truly feminist stories (Sutherland & Feltey, 2017). Compared to filmmakers like Sofia Coppola, male filmmakers almost never tell truly successful female stories (Kennedy, 2010). One of the foremost examples of this failure is the Bechdel Test, which tracks whether or not two female characters with names talk to each other about something other than men in a film (Sutherland & Feltey, 2017). This test, along with other benchmarks of feminist film, were used to determine whether or not women's stories are represented in the films analyzed.

3. Discussion

At the surface level, the five male-directed movies performed far better at the domestic box office than the five movies directed by women, as seen in Table 1. Black Panther was the top overall grossing film in 2018, with just over $700 million earned at the U.S. box office, while the top-grossing female-led film, A Wrinkle in Time, placed 33rd overall, with just over $100 million gross sales. Additionally, A Wrinkle in Time was the only movie directed by a woman in 2018 to make over $100 million at the U.S. box office. The remaining live-action male-directed movies ranked two, four, six, and eight overall. Meanwhile, the remaining live-action, female directed films placed 47th, 59th, 83rd, and 96th at the box office. Furthermore, male-directed films had much larger budgets than female-directed films. Table 1 demonstrates the issue of women generally directing fewer high budget movies than men (Lauzen, 2008).

The data comes from Kunsey's article who researched representations of women in films (Kunsey, 2018).

Title	Domestic Gross	Worldwide Gross	Budget
Male-Directed			
Black Panther	$700,059,566	$1,347,071,259	$200,000,000
Avengers: Infinity War	$678,815,482	$2,048,709,917	$321,000,000
Jurassic Park: Fallen Kingdom	$417,719,760	$1,309,484,461	$170,000,000
Deadpool 2	$324,591,735	$785,046,920	$110,000,000
Mission Impossible – Fallout	$220,159,104	$791,107,538	$178,000,000
Average	**$468,269,129**	**$1,256,284,019**	**$195,800,000**
Female-Directed			
A Wrinkle in Time	$100,478,608	$132,675,864	$100,000,000
Blockers	$59,839,515	$93,665,491	$21,000,000
I Feel Pretty	$48,795,601	$88,426,082	$32,000,000
The Spy Who Dumped Me	$33,562,069	$42,898,313	$40,000,000
On the Basis of Sex	$24,622,687	$18,348,761	$20,000,000
Average	**$53,459,696**	**$75,202,902**	**$42,600,000**

Table 1: Box Office Performance and Budget

In measuring on-set roles, this research considered the six roles noted by Lauzen in her research: director, writer, producer, executive producer, editor, and cinematographer (Lauzen, 2018). Production design was also considered in this research. As seen in Table 2, in the five films directed by men, women made up 13% of these positions, compared with 37% in films directed by women. Blockers was an outlier among female-directed films with just 17% representation. Among male-directed films, Black Panther was an outlier with 31% representation. The next highest percentage associated with a male-directed movie was 11%. The highest representation among all films was found in A Wrinkle in Time, with 60% of key roles filled by women. The movie, as stated, was the highest grossing female-directed film and the only female-directed film to surpass $100 million at the box office.

Title	Total Female	Total	Percent
Male-Directed			
Black Panther	4	13	0.31%
Avengers: Infinity War	1	16	0.06%
Jurassic Park: Fallen Kingdom	1	11	0.09%
Deadpool 2	2	19	0.11%
Mission Impossible – Fallout	1	12	0.08%
Average	**1.8**	**14.2**	**0.13%**
Female-Directed			
A Wrinkle in Time	6	10	0.60%
Blockers	3	18	0.17%
I Feel Pretty	8	24	0.33%
The Spy Who Dumped Me	7	16	0.44%
On the Basis of Sex	4	12	0.33%
Average	**5.6**	**16**	**0.37%**

Table 2: Gender Representation in Key Roles Behind the Scenes

The number of on-screen roles for men and women also differed greatly depending on director. As seen in Table 3, all five female-directed films featured a female protagonist, while none of the male-directed films featured a woman as its main character. In female-directed films, women accounted for 67% of top-billed characters compared to 20% in male-directed films. Additionally, all five films helmed by women passed the Bechdel test, which is defined as two named female characters speaking about something other than a man. In comparison, three of the five films directed by men passed the Bechdel test, with Deadpool 2 and Mission: Impossible – Fallout not fitting the criteria.

Title	**Protagonist**	**Top Billed**	**Bechdel Test**
Male-Directed			
Black Panther	Male	2 Male, 1 Female	Yes
Avengers: Infinity War	Male	3 Male	Yes
Jurassic Park: Fallen Kingdom	Male	2 Male, 1 Female	Yes
Deadpool 2	Male	2 Male, 1 Female	No
Mission Impossible – Fallout	Male	3 Male	No
Total	0 Female/5	3 Female/15	
Average	0%	20%	
Female-Directed			
A Wrinkle in Time	Female	3 Female	Yes
Blockers	Female	2 Male, 1 Female	Yes
I Feel Pretty	Female	3 Female	Yes
The Spy Who Dumped Me	Female	1 Male, 2 Female	Yes
On the Basis of Sex	Female	2 Male, 1 Female	Yes
Total	5 Female/5	10 Female/15	
Average	100%	67%	

Table 3: Gender Representation On Screen

These figures show that live-action movies directed by men generally outperform movies directed by women at the U.S. box office. That said, the five films directed by men in this study had budgets averaging $153 million more than the five films directed by women. Black Panther and Avengers: Infinity War each had budgets higher than all five female-directed movies combined, with each exceeding $200 million. Additionally, high-grossing movies directed by women involved more women behind the scenes and included more female characters than high-grossing movies directed by men. While the quantitative portion of the research does not necessarily provide any groundbreaking revelations, it gives context to the portrayals of women on screen. After viewing the ten movies in question, a number of trends can be observed concerning the portrayals and roles of women in popular film.

4. Deconstructing the Modern Female Image: A Critical Analysis of ‘Fleabag’

“Fleabag,” a British television series conceived by the prolific writer and actress Phoebe Waller-Bridge, intricately weaves the narrative fabric of a young woman’s journey through the labyrinthine alleys of an unconventional existence in London. Waller-Bridge herself assumes the mantle of the central character, embodying Fleabag with a magnetic allure that draws viewers into her world, replete with the poignant cadences of sardonic humor, profound personal losses, and an unyielding quest for self-definition amidst the ever-shifting sands of contemporary societal mores.

The series stands as a testament to Waller-Bridge’s creative prowess, earning widespread acclaim for its innovative storytelling, razor-sharp script, and performances that pulsate with an

authenticity rarely seen on screen. Notably, “Fleabag” clinched a coveted Emmy award, affirming its status as a veritable tour de force in the realm of television.

At the heart of “Fleabag” lies the enigmatic figure of its titular character, whose psyche unfurls across the episodic canvas, unraveling a tapestry woven with threads of inner conflict, familial dynamics, and the labyrinthine corridors of past traumas. Fleabag emerges as a potent symbol of defiance against the ossified strictures of societal expectations, offering viewers a compelling glimpse into the nuanced emotional landscape traversed by women in contemporary society.

The series deftly navigates the thorny terrain of female sexuality, eschewing the tired tropes and stereotypes that often plague portrayals of women on screen. Fleabag’s unapologetic embrace of her own agency and sexual autonomy serves as a potent rejoinder to entrenched societal norms, culminating in a candid monologue on masturbation that stands as a clarion call for unabashed self-expression.

The familial dynamics depicted in “Fleabag” serve as a microcosm of broader societal pressures and expectations imposed upon women. Through her fraught relationship with her sister Clare, Fleabag becomes a prism through which to examine the confluence of tradition and modernity, tradition and rebellion, and the perennial struggle for self-actualization in a world rife with gendered expectations.

Humor emerges as both a shield and a sword in Fleabag’s arsenal, wielded with a finesse that belies the depth of emotional turmoil beneath the surface. The series’signature direct address to the camera imbues the narrative with a confessional intimacy, inviting viewers into Fleabag’s inner sanctum and fostering a profound sense of empathy amidst the laughter and tears.

In its unflinching portrayal of female bodies and appearances, “Fleabag” eschews the narrow confines of conventional beauty standards, celebrating the diverse spectrum of femininity in all its raw, unvarnished glory. Fleabag’s unapologetic self-appraisal in the aftermath of a sexual encounter stands as a powerful testament to the series’ commitment to challenging societal norms and promoting body positivity.

Beyond its surface charms, “Fleabag” serves as a trenchant critique of the patriarchal structures that underpin contemporary society, shining a harsh light on the insidious manifestations of toxic masculinity and gender inequality. Through its incisive storytelling and unflinching gaze, the series emerges as a potent vehicle for social commentary and cultural critique, challenging viewers to interrogate their own complicity in perpetuating systemic injustices.

In the grand tapestry of contemporary television, “Fleabag” stands as a towering achievement, a bold and audacious testament to the power of storytelling to effectuate meaningful change. By juxtaposing traditional depictions of female characters with Fleabag’s indomitable spirit and unapologetic complexity, the series serves as a harbinger of a new era in which women’s voices are amplified and their stories celebrated in all their multifaceted glory.

5. Conclusion

The analysis presented in this research paper underscores the enduring challenges and complexities surrounding the portrayal of women in popular cinema. Despite the strides made by social movements like #OscarsSoWhite and #MeToo in advocating for greater diversity and representation within the film industry, significant disparities persist in both on-screen and behind-the-scenes roles.

The quantitative examination of the top-grossing live-action films of 2018 directed by men and women reveals a stark contrast in terms of box office performance and budget allocation. Male-directed films generally outperformed their female-directed counterparts, often commanding larger budgets and securing higher domestic box office grosses. However, it’s crucial to note that this discrepancy in financial success does not reflect the quality or cultural impact of the films themselves, but rather systemic inequalities in resource allocation and market access.

Furthermore, the qualitative analysis of the films reveals nuanced differences in the representation of women on screen and the involvement of women behind the scenes. Female-directed films tended to feature more diverse and multifaceted female characters, passed the Bechdel test more frequently, and exhibited greater gender parity in key production roles compared to male-directed films. This highlights the importance of diverse voices and perspectives in shaping authentic and inclusive narratives that resonate with audiences.

The case study of "Fleabag" offers a compelling example of how storytelling can challenge societal norms and conventions, offering a nuanced exploration of female identity, sexuality, and agency. Through its unflinching portrayal of complex female characters and incisive social commentary, "Fleabag" serves as a beacon of progress in the landscape of contemporary television, pushing boundaries and sparking important conversations about gender dynamics and representation.

In conclusion, while significant strides have been made in recent years to address the systemic inequalities within the film industry, much work remains to be done. By fostering greater diversity, inclusion, and equity in both on-screen portrayals and behind-the-scenes decision-making, the film industry can aspire to more accurately reflect the rich tapestry of human experience and empower marginalized voices to tell their own stories. Only through collective action and a commitment to change can we truly create a cinematic landscape that celebrates the full spectrum of gender identities and experiences.

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Consistency and Some Other Requirements of a Formal Theory in the Context of Multiverse Models[1]

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Abstract:
The paper is devoted to the problem of describing reality in the language of mathematics and logic in connection with intellectual intuition. The question raised is how the basic requirements of mathematical theory and logic will change if some of the multiverse models of modern physics are taken as the basis. Mathematics is considered in the context of various historical approaches. It is shown that some of the well-known requirements of a formal theory (such as consistency) may begin to play a different role if the multiverse hypothesis is accepted. In the framework of theories based on the idea of multiple worlds, the logical consequence, the natural law of Duns Scotus, the law of excluded middle, and other well-known facts of classical logic which in some cases cause controversy due to their intuitive unacceptability are resolved. The paper discusses an approach based on paraconsistent logics: such logics can be considered the first to correspond to multiverse theories.
Keywords: consistency, contradiction, formal theory, multiverse theories, philosophy of science, intellectual intuition.

1. Introduction

A considerable number of works have been written on the philosophy of mathematics. Philosophy of mathematics experienced particularly significant development with the emergence of various programmes for establishing the foundations and development of mathematics in the first half of the twentieth century. It was as a result of a crisis, the prerequisites for which formed explicitly in the nineteenth century and even earlier in a latent form.

The main questions that the first philosophers of mathematics (who were themselves mathematicians) tried to answer were essentially what mathematics is, what exactly it studies, what the status of existence of what it studies is, what the criteria for the truth of mathematical knowledge are, what its place among other sciences is, and others. In the context of this study, mathematics is considered as the maximum abstraction of intellectual intuition in describing reality. The main goal of this study: to clarify the role and content of some mathematical concepts in the context of multiverse theories. This is not so much about the possible worlds of mathematical logic

as about the models of multiple worlds that modern physics offers (for example, quantum multiverse, inflation, string theory, etc.).

Although multiverse theories are only hypotheses, they are all consequences of working mathematical structures describing the corresponding physical reality within the framework of specific physical theories, some of which rely on a strong experimental basis (quantum mechanics in the form of the standard model of particle physics and general relativity).[2] For this reason, they deserve studying, not necessarily in and of themselves (enough has already been written about this) but in connection with mathematical analysis and formal logic in relation to the cognition, perception, and description of reality. This is a relevant problem, and in this perspective, the classical foundational programmes of mathematics can suddenly sparkle with new colours and be further developed.

In this paper, a hypothesis will be formulated, according to which the requirements of a theory, such as consistency (as well as some accompanying requirements), may turn out to be non-obligatory (or even impossible) under conditions of theories that claim to describe all possible worlds as equal, and not just one particular world—our world, with which the theory is correlated in the experiment. It is substantiated that an increasing degree of abstraction in intellectual intuition naturally leads to such results. This allows us to take a fresh look at well-known logical principles, such as "anything follows from a contradiction", eliminating their intuitive unacceptability observed in a number of cases.

The structure of this article is as follows. The second section considers the nature of mathematics, while the third section explores the concept of intellectual intuition. The fourth section briefly examines the historical debate surrounding the essence of mathematics and logic. The fifth section discusses the connection between the logical principle of noncontradiction and intuition. In the sixth section, a possible solution is proposed using a paraconsistent logic and multi-world approach to address the issue. The seventh section explores the relationship between Platonism, contradictions, and intuition. In the eighth section, it will be demonstrated that a many-worlds interpretation of quantum mechanics provides a promising avenue to resolve the contradiction between intuition and some logical principles. Finally, in the ninth section, conclusions will be drawn and prospects for future research will be outlined.

2. Formulation of the Main Concept

In order to achieve the objectives of the study concerning the philosophical problems of mathematics in different aspects, it is necessary to understand the specifics of mathematics, its essential characteristics—or, speaking in the language of logic, to formulate the concept of mathematics.

There are many different approaches depending on the starting position as regards mathematics and what it does. Modern mathematics can be seen as the limit of abstraction, in the sense that it is an abstract description of reality;[3] there may already be serious objections here, but our position is close to that expressed in the article by Bangu (2020), where the explanatory role of mathematics is quite convincingly substantiated.

Of course, mathematics itself—or rather, the way it was used—was not initially abstract: the mathematical descriptions of Babylon, Ancient Egypt, and Greek Antiquity were close to the natural language, which, in turn, was close to concrete things. However, the entities behind this description, such as geometric figures and numbers, are abstract in the sense that, for example, the square root or the operation of addition do not exist as observable natural phenomena. As science developed, mathematics became more and more abstract both in its content and in its language. Obviously, these were interconnected processes: the growth of abstraction contributed to the development of science, and vice versa.

One can also take the view that the whole of science, in almost all its fields, tends to move away from the description bound to usual observations of concrete phenomena to their abstract analogues.

For example, medical, geographical, mathematical, and physical representations of Antiquity and the Middle Ages were accompanied by images and metaphors (including mythological ones) of the cultural space of that time. However, science is currently experiencing a kind of evolution: it is gradually cutting off extraneous objects and moving towards the greatest level of abstraction in order to isolate the subject of research for the purpose of achieving greater accuracy and specificity, and, importantly, for the purpose of talking only about the object of the study and not about something else that has nothing to do with it.

Of course, this applies to the greatest extent to the natural sciences. The philosophy of science uses predominantly natural language, and the words of natural language and connections between them are inevitably ambiguous, metaphorical, and even mythological, although we can still observe an increase in the level of abstraction, which consists in moving away from colloquial concepts based on everyday experience of interaction with reality. At the same time, it cannot be said that philosophy in general has moved away from imaginary entities to which nothing corresponds in the observed reality: indeed, it actively operates with them. However, mathematics and even physics can be reproached for the same.[4]

For a number of scientists, this serves as an argument in favour of saying that there is no need for the philosophy of science (due to a lower level of abstraction compared to what it describes), and thus such description and interpretation is not progress in intellectual intuition but, on the contrary, a regression. From our point of view, even if this objection is to some extent true, the philosophy of science is necessary because it makes it possible to highlight and outline ways to solve the problems that science faces: in its baggage, it has the whole array of knowledge about the continuity and development of ideas in history of science.

Thus, mathematics is currently the height of abstract description.

3. Some Traditional Views That Need to Be Considered

The root of many problems in attempts to clarify the foundations of mathematics is the ambiguity of the essence and nature of intellectual intuition. There is no such category of intellectual intuition in modern neuroscience; it is a philosophical abstraction designed to denote a certain thinking ability. Of course, it is very likely that intuition is provided by certain neural connections in different parts of the brain, but our task here is not to engage in neurobiology. There is extensive literature in the philosophy of mathematics devoted to intellectual intuition—a recent monograph by Linnebo (2020) provides an overview of this and other problems based on modern research—but that is not exactly what is usually understood by intuition in philosophy.[5]

In philosophy, discussion of intellectual intuition most often refers to Descartes, as well as to the ideas of Spinoza, Hume, and Locke, and the more complex concepts of Kant, Fichte, Schelling, and others; though, in doing so, there is more often talk about "intellectual contemplation", which can be equated with intuition. Intuition is declared to be characterized by such features as obviousness, clarity, distinctness, reliability, fundamentality, and others. In general, Descartes's formulation in which he calls intuition the undoubting conception of an unclouded mind (Descartes, 1989, p. 84) is still relevant, though with some reservations (taking into account the vagueness of natural language definitions). For a better understanding of intellectual intuition, we should add that it is also a specific ability common to all mankind—the ability to think using some universal principles as the basis. The existence of such intuition is indicated, for example, by the general relative unanimity in acceptance of the basic rules of thought (the laws of classical logic, which are considered to be common to all), the ability to understand and accept mathematical proofs, and the existence of a consensus on this issue. In a recent article, Chudnoff (2020) proposes to distinguish three types of intuition: intuition obtained in the course of experience; improved intuition that contravenes what is based on common sense; and guided intuition, in which an expert teaches a novice). Van-Quynh (2019), adhering to the same position, shows an analogy between mathematical intuition and ordinary (perceptive) intuition based on phenomenology.

It is important for us that mathematical intuition is more abstract due to weaker association with the directly observable reality that forms the initial intuition. However, the differences are not so fundamental, in that we can talk about the development of intuition in general, and that it can be improved. Therefore, we will ignore the division of intuition into types, not distinguishing between ordinary and mathematical intuition, believing that the latter is the result of the growth of abstraction level in the former.

What is the nature of this intuition? Is it due solely to cultural factors, the environment, or are there genetic factors that set some general principles for the formation of the human brain? Both are likely to be the case; recent brain-mapping projects (Filler, 2009) provide indirect evidence that some of the sociocultural factors that have traditionally been considered a product of social life may be of biological origin and arise in the course of evolution (requiring, nevertheless, development in the social environment): take, for instance, the capacity for abstract thinking, which is closely related to the assimilation of grammatical structures.

Leaving this complex issue aside, let us confine ourselves to some general remarks. First, intuition evolves.[6] This is easy to prove in the example of the development of mathematics. Such concepts as negative numbers, irrational numbers, or complex numbers seemed alien and incomprehensible even to medieval mathematicians in the sense that these were counterintuitive constructions. Today, it is difficult to surprise anyone with negative numbers, except for those tribes that are relatively isolated from civilization and lead a primitive way of life, where mathematics has not received any development and, for example, where there is practically no counting system (Everett, 2007). To us, negative numbers seem quite intuitive because we master the basics of mathematics at an early age. The same applies, for example, to the principles of general relativity: to scientists of the Newtonian era, they would have seemed unimaginable and counterintuitive, while to modern physicists, they seem to be completely obvious in terms of intuition (and, indeed, representable: Einstein formulated them based on geometric representability). A similar situation can probably be observed as regards quantum mechanics: a more than a century-old problem of interpreting quantum mechanics ceases to be a problem due to the gradual assimilation of its provisions as fundamental, as part of everyday (scientific) experience (for example, the adoption of Everett's interpretation of decoherence makes quantum mechanics intuitively acceptable[7]).

Thus, intuition is apparently developing, gradually embracing what was previously unimaginable and incomprehensible in the scientific worldview system. Presumably, this is a natural process.

Of course, not everything is as obvious with quantum mechanics as with general relativity. That is explainable (moreover, the explanation itself points to the fact that intuition is at least conditioned by evolution, if not fully formed by it). Indeed, in the course of evolution, man, like any other organism, adapted to environmental conditions. However, perception of macroworld objects is essential for survival: it is they (and not electrons, photons, or quarks) that influence the effectiveness of everyday decision-making and participation in natural selection. In other words, knowledge about the microworld, about its properties, and about the behaviour of elementary particles is useless from the point of view of survival in nature. The sensory organs and the corresponding brain structures of organisms are hardwired for orientation and action in the macroworld and are not intended (or are intended, but to a very small degree) for interaction with objects in the microworld.

It is logical to assume that intuition is conditioned by the same evolutionary factors. Thus, it becomes clear why quantum mechanics is usually considered counterintuitive: in fact, many of its provisions contradict classical intuition and the classical physics based thereon. But as it becomes part of experience—and quite tangible, at that: the operation of modern electronics is based on the laws of quantum field theory—it becomes intuitively acceptable.

Of course, the statement about the universal character of human intuition is debatable, which can be illustrated by the axiom of choice, the law of excluded middle, double negation elimination,

infinite sets, and so on. There is no complete consensus yet concerning these constructions, and one cannot exclude the possibility that one will not be reached at all.

It is clear that there can be different intuitions—but within certain limits: there is hardly an intuition for which the statement 2+2=4 turns out to be counterintuitive, although there are objections here as well.

4. The Schools

Here we will consider some of the traditional positions in the philosophy of mathematics and try to formulate an answer to them that is consistent with our position.

The crisis in the foundations of mathematics, which arose in the context of the interpretation of Cantor's set theory, led to the emergence of various programmes establishing the foundations of mathematics. It is worth remembering that some paradoxes arose in set theory which actually indicated its inconsistency—for example, Russell's paradox, Cantor's paradox, Richard's paradox, Burali-Forti's paradox—as well as a number of other problems, such as the problem of doubling the ball as a result of applying the axiom of choice. For example, Cantor's paradox states that if the set of all sets *V* exists, then the cardinality of no set can exceed its cardinality. However, it turns out that the set of all subsets has a greater cardinality than the set of all sets; hence the latter cannot exist.[8] In other words, there is no greatest cardinal number. In philosophical terms, this paradox is close to the omnipotence paradox.

The three programmes designed to build mathematics on a solid foundation free from paradoxes have become known as formalism, intuitionism, and logicism (for a detailed analysis of the approaches with authentic texts of their main representatives, see van Heijenoort, 2002; Snapper, 1979).

In short, the task of the formalist movement, led by David Hilbert, was to try to reduce the foundations of mathematics to the study of formal systems. That is, he believed that for any mathematical theory it is possible to build a system of axioms and rules and set the rules of inference on the basis of which all possible theorems of this theory are derived; thus it is possible to prove its consistency and completeness. An example of such a system is Gentzen's sequent calculus. It is clear that the creation of such systems is based on the principles of logic.

Intuitionism, led by Luitzen Brouwer, considers it necessary to build mathematics on obvious intuitive foundations, as structures that are completely generated by our mind and do not exist independently. Thus, the axiom of choice was declared counterintuitive, since it does not allow constructing objects: it only says that they exist, and, according to intuitionists, mathematics must propose a way to construct the objects under study. In intuitionistic logic, double negation elimination and the law of excluded middle are questioned, and hence also proof by contradiction. Proving consistency of a theory is declared superfluous, since intuition itself does not contain contradictions; actual infinity is denied, as intuition deals only with finite sets, and so on.

Logicism (Frege, Russell, Whitehead) insists on the possibility of deriving all mathematics from logical foundations. The idea in general terms is that it is possible to build a logical system that will serve as the basis for any mathematical constructions. This can be interpreted as stating that there is some basic logical intuition (laws of thought inherent in human consciousness), and it is primary in world cognition. Here, too, there were some paradoxes: Russell's paradox shows that Cantor's set theory and Gottlob Frege's attempt to formalize it are contradictory. Russell, trying to get around the problem, introduces in particular the axiom of infinity, which, strictly speaking, is not logically justified or intuitively acceptable (at least not for everyone—it requires the existence of an infinite set).

As for the formalist programme, the hope of proving the completeness and consistency of any correct system based on formal arithmetic turned out to be unrealizable, as is well known. Completeness of a theory requires that for every statement that is provable in this theory, either *A* or the negation of *A* can be derived. Consistency requires that statements *A* and *not A* should not be

simultaneously derived in the theory. Consistency is so important because derivability in the theory of contradictions leads to the fact that any statement in this theory becomes true. (In classical logic, anything follows from a contradiction: if the antecedent is false, then the statement is true for any consequent, and the contradiction is always false—that is statements *A* and *not A* are an always-false formula.)

Kurt Gödel showed in 1930 (see new edition; Feferman, 2001), firstly, that if formal arithmetic does not contain contradictions, then it has a formula that is underivable and true (irrefutable). This actually indicates the incompleteness and insolvability (absence of an algorithm for proving any true theorem in the system) of a consistent theory. Secondly, he showed that if formal arithmetic is consistent, then it is impossible to derive a formula asserting its consistency. So, consistency cannot be proved, and formal arithmetic is the basis of any mathematical theory (where natural numbers, addition, and multiplication must be defined); thus, this is a problem of all mathematics, and Hilbert's programme—the second problem in Hilbert's list—turns out to be impossible (Hilbert, 1902). Gerhard Gentzen's proof of the consistency of arithmetic using primitive recursive arithmetic requires an additional axiom for transfinite induction and does not solve the problem of completeness (Kleene, 2012).

The intuitionistic programme on the whole turned out to be very difficult in terms of proofs due to the restrictions it introduced. It places severe restrictions on the area of the unprovable (including what has already been proved) and has drawn criticism due to its counter-intuitiveness and its disputes over what is to be considered intuitive and what is not.

In general, though, such statements as the law of excluded middle may indeed seem counterintuitive: it states that either *A* or *not A* is true, regardless of what *A* is—i.e. regardless of whether we can define and construct it. If we cannot, then, from the point of view of intuitionism, it is neither true nor false until it is proven true. However, for most logicians and mathematicians, any statement is still true or false regardless of our knowledge of it. Generally speaking, this leads us to mathematical Platonism (see Tieszen, 2011, which discusses the emergence of mathematical Platonism and its roots in the philosophy of Plato, Leibniz and Husserl, and Gödel's attitude to Kant's position), which is not acceptable for intuitionism.

Nevertheless, it would be wrong to dismiss intuitionism as an incident . The intuitionistic logic built on its basis turned out to be quite efficient, and the requirement that the objects in question be constructible is welcomed in some important sections of modern mathematics.

One of the problems that gave rise to the abovementioned approaches was the problem of consistency. By itself, the requirement that a theory should not produce theorems that contradict each other seems quite intuitively acceptable. But, as already noted, in classical propositional logic, there is the law that anything follows from a contradiction. Thus, if there is a contradiction in a theory, any formula in it is a theorem (any one that can be constructed according to the definition of a formula in this theory). This position no longer seems intuitively obvious: why should anything follow from a contradiction from a substantive point of view? (It is, though, from a formal point of view, easy to prove in classical logic; as already noted, with a false antecedent, the whole formula will be a theorem).

5. Logic and Intuition

The question arises: how does classical logic correlate with physical reality? And can there be situations (worlds) that allow contradictions?

There is an infinite number of contradictory formal systems, which are often referred to as paraconsistent logic, the prefix *para-*, of course, not implying any mystical content in this case. Szmuc et al.'s (2018) collection of articles *Contradictions, from consistency to inconsistency*, devoted to the problems of contradiction and consistency, gives an overview of the nature of such systems. These are logical systems in which the law of non-contradiction is not a law. Therefore, nothing follows from a contradiction in them. Obviously, such logics describe worlds in which

contradictions are admissible. Certain facts and negations of those facts can occur simultaneously, but that does not lead to triviality.[9]

Interestingly enough, one can obtain paraconsistent logic from any multi-valued logic:

> The simplest and most illustrative way to construct paraconsistency is to add a third truth value *S*, interpreted by different authors as "antinomical", "paradoxical", or "contradictory", to the two classical truth values 1 (true) and 0 (false). Taking 1 and *S* as designated truth values, and taking *S* as a fixed point, which allows us to define negation as $\neg(S) = S$, we have a case where $(p \ \& \ \neg p)$ takes a designated value. Obviously, these logics, like the classical one, are truth-functional. It is not difficult to construct such three-valued logical matrices in which the *modus ponens* rule works, but Duns Scotus's law does not (Karpenko, 2001, web).

The same applies to relevant and modal logics: it is easy (and natural) to construct paraconsistent logics in them (see Jaśkowski's discursive logic, which some consider the first consistent logic historically; Jaśkowski, 1969).

In all these systems, one can consider situations (choosing appropriate interpretations) when *A* and *not A* occur, but, say, *B* does not, and thus there is a contradiction (*A and not A* is true), but one cannot say that anything follows from it.

A separate question is how negation should be interpreted. This problem arises in intuitionism in connection with double negation elimination: what exactly is meant by negation and can negations be semantically different? For example, the statement "It is not true that it is not raining" in classical propositional logic is equivalent to the statement "It is raining". Intuitionists do not agree: maybe there is some third option. From here, it is one step to multi-valued logic and the transition to paraconsistency.

However, here we will concentrate on another problem, closer to our objective. The question we are primarily interested in is what world (worlds) in the physical sense can be described by this or that logical theory and the corresponding mathematical structure.

6. Possible Solution

The approach to solving the problem that we propose is based on multiverse physical concepts. In this case, it does not really matter on which ones exactly; for our purposes, we can use Everett's many-worlds interpretation (Everett, 2015), the chaotic inflation scenario (Linde, 1982, 1983), the string landscape model (Susskind, 2003), the brane world scenario (Yau & Nadis, 2010), and others. Though all of these multiverse models are certainly hypothetical, and no experimental verification is expected to confirm any of them, this does not matter so much here, since we are discussing the problem in the context of logical and mathematical approaches (and the corresponding intellectual intuition), and all these hypotheses are consequences of working mathematical theories, some of which do not raise any doubts about their adequacy and effectiveness due to their compliance with the experimental criterion.

Multiverse theories assume the existence of a set of worlds (it can be finite or infinite, as, for example, in the chaotic universe model) which realize all statistically possible states of reality (for example, in the many-worlds interpretation). These states are a reflection of the possible outcomes of events and ways of realization of the known laws of physics, and, more broadly, ways of realization of the laws of nature—i.e. the fundamental principles that underlie any possible universe. Thus, if we take our universe as the starting point, then among the many worlds we can find duplicates of our universe, worlds that differ to a certain extent, and fundamentally different worlds with other fundamental physical principles.

Models that claim to be extremely broad descriptions of reality (superstring theory, M-theory, chaotic inflation theory, and the string landscape model combining these approaches)

describe sets of possible worlds and do not have tools in their arsenal for binding the theory specifically to our world (Karpenko, 2017). They speak about the multiple possible universes as equal in their rights, not describing only one kind of universe: therefore, the characteristics of our universe in particular (for example, the properties of the observed elementary particles) are not deduced in those theories; they have to be substituted into the equations manually within certain models (e.g. in the standard model of particle physics). An experiment does not play the traditional role in such a theory because in different worlds, depending on different initial physical conditions, it will give different results.[10]

In the context of this study, it is important that among the many worlds, there may be such worlds in which conflicting events occur. For example, the statement "Intelligent life exists" is true in world *N*, but it is false in world *M*. Suppose there is some theory *T* of a set of worlds which is not bound to the description of any one of the worlds (as, for example, Newton's mechanics is bounds to ours), and it describes a variety of worlds, including *N* and *M*. In that theory, a conjunction of these statements ("Intelligent life exists" and "Intelligent life does not exist") will seem, of course, a contradiction (*A* and *not A*). However, in the theory *T*, it will be true.[11] Does anything follow from it? Obviously not.

7. Platonism, Contradiction, and Intuition

Simplifying somewhat, Plato's theory of ideas (developed in his dialogues, the *Timaeus*, the *Parmenides*, and the *State*) can be expressed as follows: there are ideal prototypes of things in the observed world (*eidos*), and it is they that really exist, not the observed world. The latter is rather a shadow, a reflection of the world of ideas (although this is not entirely correct, because in some places it is argued that there is no connection between the world of ideas and the world of shadows, and therefore knowledge should be directed not to the study of the properties of the observed world but to the ideal world). It is this notion—that cognition should be directed to the world of ideas, bypassing the sensorially cognizable—that appeals so much to many mathematicians. Modern adherents to mathematical Platonism regard only mathematical objects as ideas, and it is their combinations into various structures that give rise to all the diversity of what we perceive sensorially. Extensive literature is devoted to the issue of mathematical Platonism. We proceed from the formulations set out in the classic work by Balaguer (1998), where anti-Platonic positions are also considered, as well as from a more modern and detailed monograph (Panza & Sereni, 2013): mathematical Platonism can be considered precisely as the maximum level of abstraction, moving from observed phenomena to their mathematical prototypes. In his important article, Côté (2013), considering the counterintuitive properties of such an abstraction as infinity, proves that they lead to mathematical Platonism. He also shows how the presence of abstract infinity explains why there is something in the universe instead of nothing, thus solving the old Leibnizian problem in an original way.

Plato, though, has an intermediary between the ideal world and the sensible world—the space, which is necessary for practising geometry. Modern mathematical Platonists do not need such an intermediary; for them, mathematical structures are the reality that stands behind the visible reality, and these structures are abstractions that are not connected with anything sensorially perceived: they do not look like anything; they are completely abstract ideas. Obviously, for the mathematical Platonist there is no problem of cognizability of things in themselves, because noumena are comprehended by mathematical intuition.

The mathematical universe hypothesis, proposed by Mac Tegmark (1988) as the basis for a "theory of everything", adheres to this very position—to the reality of the variety of mathematical structures that can be considered as bits of information describing this or that virtual reality (everything observed, sensorially perceived, turns out to be virtual in this sense). Our mind in this case is able to perceive pure ideas (mathematics) but for some reason transforms them into what we call the sensorially perceived.

Tegmark (1988) proposes a model in which the multiverse is realized as a set of different mathematical structures. There are many such structures, probably an infinite number, since each mathematical structure can be considered a kind of universe.

In this context, the question arises: is mathematics as a means of describing reality universal or not? If the answer is positive—i.e. there is universal mathematics, as well as universal intellectual intuition, then the entire multiverse is cognizable within the framework of universal intuition. However, this has nothing to do with the requirement for consistency. That is, different mathematical structures in the multiverse can contradict each other and be incompatible within the same universe.

In other words, the consistency criterion can be considered as a requirement that implies being bound to describing the directly observed reality, which gives consistent results in an experiment. From the point of view of the multiverse, however, the requirement for consistency is unreasonable—just a convenient limitation for practical purposes.

Let us take an example from formal arithmetic: 2+2=4. Contradictory to it will be the statement "It is not true that 2+2=4", which does not mean at all that 2+2 must not be equal to only 4 and nothing else. It only says that 2+2 does not equal 4, but this does not mean that the sum cannot be equal to something else—for example, 5. That is, the statement "2+2=5" is not contradictory to "2+2=4." What is it contradictory to? Only to the statement "It is not true that 2+2=5".

These are very important nuances for understanding the essence of contradiction in general. The statement "This person is alive and dead" does not contain any contradiction, only an opposition of states, while the statement "This person is alive and this person is not alive" does contain a contradiction; it is false in classical propositional logic. Furthermore, one can argue whether "dead if and only if not alive" is a tautology, which is debatable, because different interpretations are possible. That is, the question is, how do truth functions correlate with various states? Quantum logic deals with states and not with truth functions—that is, in our example, with the states "alive" and "dead", as well as with superpositions ("alive and dead", "not alive and not dead"), which are between these extreme states, but not with questions like: "Is the statement 'an object is alive and not alive' true?" However, in quantum mechanics, the answer to such a question is obvious: "Yes, it is true" (that is a superposition), which in the many-worlds interpretation corresponds to intuition.

8. Many-Worlds Interpretation

If we adhere to the Copenhagen interpretation of quantum mechanics, with the collapse of the wave function, then the usual connection of the observed facts to a specific universe—the one in which the experiment is being set—is preserved. That is, the experiment shows the correspondence of the theory to the observed reality: in this case, the theory must predict the results of the observation. There is one physical reality—our world, with its set of laws of nature—and the theory describes it. The collapse of the wave function is the result of observing the world. The question remains: why do the objects of the microworld, when the wave function collapses, choose one single location out of many possible ones, although, according to the Schrödinger equation, before the act of measurement they were in a superposition—that is, in all possible places at once? This interpretation lacks an explanation, an answer to the question of why. The answer for the Copenhagen interpretation is "for no reason". This is how reality behaves, this is its property, and our attempts to explain it do not point to limitations of the theory but to limitations (underdevelopment) of our intellectual intuition, which is looking for classical explanations where they do not exist. In other words, you do not need to ask questions that do not make sense—you just need to describe the results of the experiment.

However, it seems to us that an explanation is still possible. The introduction of the wave function of the universe, which is proposed in Everett's many-worlds interpretation in 1957, provides such an explanation. All outcomes occur and there is no collapse of the wave function;

what we observe as a collapse is the realization of a specific outcome from a set of outcomes in parallel worlds. If we add decoherence—the interaction of the quantum mechanical system with the environment leading to violation of coherence, as a result of which it acquires the features of a classical (macroscopic) system, first described by Zeh (1970)—then the problem of contradiction between the behaviour of the microworld and the macroworld is also solved.

What does this mean in the context of the problem we are considering? The Schrödinger equation describes the evolution of the system in time; the set of its states is a superposition of all possible outcomes. Quantum mechanical probability does not coincide with classical probability: it allows for a kind of "mixing" of states—that is, not "the electron is either here or there", but "the electron is both here and there".

Let us consider the requirement for consistency in this context. Contradictory to the statement "The electron is at point *A*" will be the statement "It is not true that the electron is at point *A*". Actually, a conjunction of these statements will not be true in any specific universe but will be true—recall that a conjunction is only true when both of its terms are true—in the multiverse of the many-world interpretation. In a universe *X*, which differs from *Y* by nothing else but the location of the electron *N*, electron *N* is found at point *A*, while in universe *Y*, it is not found at point *A*. Does any statement follow from this conjunction? (We recall that in classical logic anything follows from a contradiction.) Obviously not. But some true statement may follow from it.

The statement "It is not true that the electron is at point *A*" can be reformulated as "The electron is not at point *A*"; thus the conjunction becomes "The electron is at point *A* and the electron is not at point *A*". This contradiction is perhaps closer to quantum superposition and is also true.

9. Conclusion

In classical propositional logic, "Intelligent life exists and intelligent life does not exist; therefore, a round square exists" is true; however, one cannot apparently speak of the intuitive acceptability of such truths, at least because there is no connection between the premise and the conclusion. Relevant logic tries to get around this by reasonably demanding a connection between the antecedent and the consequent, which under certain conditions lead to a paraconsistent system which may seem intuitively acceptable only given the multiverse. In a set of possible worlds, the statement "Intelligent life exists and intelligent life does not exist" is true, and no unrelated statement must follow from it, especially because, if it is false, then the result will be false (since there is no reason to doubt the falsity of the formula with its true antecedent and false consequent). In multiverse theories, the statement "Intelligent life exists and intelligent life does not exist; therefore, a round square exists" is false, which, in our opinion, is more intuitively acceptable.

With the acceptance of multiverse concepts as they are presented in modern mathematics and physics, the requirement for consistency begins to look like a requirement for proximity to the description of the observable universe, since the law of consistency must apparently be observed within a single universe, although it is not clear whether that is obligatory for any possible universe. Rejection of the need for such a correspondence to the observed reality is the development of intellectual intuition, in the direction of increasing the level of abstraction, since multiverse theories are basically mathematical abstractions.

Logic based on quantum superpositions can be regarded as one contender for the description of such a reality: it is somewhat close to intuitionism—there are no laws of excluded middle in it, and the requirement for consistency is abandoned as restrictive.

Whether it is possible to build such a logic, which would form the basis for a "theory of everything" describing all possible worlds, is not yet clear. Studies in the field of quantum logic touch upon only some of the aspects of the problem that are discussed here.[12] This paper has aimed to show that consistency is not an unconditional intuitive condition reflecting the laws of nature. Rather, it is due to the applied functional nature of the theories focused on the description of the observable universe and the limitations of the corresponding intellectual intuition.

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Notes

1. Acknowledgments: The paper is supported by the RSF, project No. 22-18-00450.
2. Extensive literature is devoted to the issue of multiplicity of worlds. The history of the issue from Antiquity to modern times is considered, for example, in Vizgin (2007), as well as in the classic monographs (Lewis, 2001; Pruss, 2011), where the problem is considered more generally. Talking about more modern approaches not considered in the indicated sources, we will refer to current studies in the field of philosophy, physics, and mathematics.
3. A recent collection of works edited by Lektorskii (2017) and devoted to the problem of realism in philosophy examines approaches from the standpoints of philosophy of science, epistemology, and philosophy of consciousness.
4. All mathematics can be regarded as imaginary if one does not adhere to mathematical Platonism, as well as a significant part of physics; for example, the key concept of quantum mechanics, the wave function, is a mathematical abstraction. For quantum realism, see Terekhovich (2019).
5. However, the article (Tieszen, 2015) shows the connection between mathematics and philosophy in the matter of intuition: the mathematical intuition of Kurt Gödel turns out to be derivative of the philosophy of Husserl and a number of other philosophers. See also Weinberg et al. (2001).
6. Porus (2021) essentially says this in his article on historical epistemology and the need for reform of the philosophic theory of knowledge, but in other terms, citing the evolution of intellectual intuition as the condition.
7. Though, of course, not for everyone.
8. A possible solution is to abandon the principle of abstraction, which states that for any property *P* there is a set that consists of those and only those objects that have this property *P*.
9. Triviality is observed when the set of formulas and theorems of the theory coincides (this is exactly what will happen with theories built in classical logics if contradictory theorems are derived in them).
10. But the experiment is important for finding out the parameters of the particles of our universe and substituting them into the theory. See also Pronskikh (2021) on the problem of reproducibility in a scientific experiment.
11. Since the theory describes all possible worlds and the totality of facts about them. Of course, within one particular world, such a statement will be false.
12. The first attempts were made quite a long time ago (see, for example, Birkhoff and von Neumann, 1936); a more recent work is the monograph by Vladimir Vasyukov (2005).

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Did Antinatalism Precede Philosophy?

Abstract: The interview given by Matti Häyry, PhD, Professor of Philosophy of Management at the Aalto University School of Business. Prof. Häyry has been involved in reproductive ethics and antinatalist philosophy since 1984. His 2004 A rational cure for prereproductive stress syndrome is considered to be the first expression of the so-called risk argument against procreation. His most recent publications on the topic, with Amanda Sukenick, include Imposing a lifestyle: A new argument for antinatalism and *Antinatalism, Extinction, and the End of Procreative Self-Corruption*. The origin and evolution of his views have been chronicled in detail on The Exploring Antinatalism Podcast, especially in its episode #65 and in episodes #1, #2 and #3 of its subchannel Hankikanto – Falling into the Anti/Natal Abyss.
Keywords: antinatalism, ethics, history, life, morality, procreation, rationality, reproduction, risk.

Konrad Szocik: You are one of the main representatives of antinatalist philosophy. Could you present your understanding of antinatalism? Which of the antinatalist arguments do you consider the most crucial?

Matti Häyry: I may be one of the main representatives of antinatalist philosophy but I have been aware of it only for a year or two. I published twenty years ago an article arguing that having children is irrational and immoral, and I returned to the topic sporadically, but it took an antinatalist activist, Amanda Sukenick, to invite me to a podcast interview and offer collaboration to get me up to speed. So I am still trying to understand what is what.

When I am at my most cautious, I say that, instead of an antinatalist, I am an antinatalist philosopher. That, to me, means that I do not have children, that I do not intend to have children, and that I would have nothing against everybody else acting like me in this respect. When I let my caution go a little, I say that I would be pleased to see everybody else acting like me in this respect. There is a slight hint of Kantian ethics in the latter.

The next step would be to say outright that everybody has a duty to abstain from reproduction. But although I do have grounds for that I usually limit myself to saying that there is a very strong prima facie case to abstain but there can be mitigating factors. I have used a very complicated two-value-conflict-responsive-negative-utilitarian theory to justify that evasive view.

If asked what antinatalism more generally is, I have different answers on different levels. The most general is that antinatalism means being against reproduction on moral grounds. This leaves all the specifics to be determined later and only makes the claim that one should be opposed to organic or machine self-replication. The next one defines antinatalism as the philosophy and

social movement that questions reproduction. Nothing much added to the previous one, just the explicit inclusion of both theory and practice.
The most complex definition that I currently have in mind states that antinatalism means the abstinence from bringing or refusal to bring or prevention of bringing into existence sentience or life or objects of manipulation or hegemonic power. But that is for more advanced purposes within antinatalist scholarship.

The standard justifications for antinatalism are that all lives are bad (the person in the street disagrees), that we do not have the permission of those we are planning to bring into existence (philosophers point out that we do not have their permission not to bring them into existence, either), and that the future individual could have a horrible life.

My article twenty years ago gave the first official formulation of the last one, known as the risk argument for antinatalism. I am still working to hone it – that latest version, the Omelas argument, appears in *Antinatalism, Extinction, and the End of Procreative Self-Corruption* that I just published with Amanda Sukenick.

Konrad Szocik: The decision to procreate is perhaps the most important decision of one's life, because of its effects both on the reproducers and those brought into the world. Yet both non-philosophical people and even philosophers pay surprisingly little attention to it – or none at all. What do you think this is due to?

Matti Häyry: Reproduction is a very normal part of normal human lives, and most people want to have normal human lives. The model is culturally ingrained into our minds and difficult to avoid or fight. As for philosophers, however, I have an important revelation for you.

The first part of our book tells the story of antinatalism and its foes in European thinking, and we claim that Western philosophy since Plato is in fact just a long string of critical reactions to antinatalism. The underlying current in our culture is the lack of meaning in human lives, well detected by ancient Greeks. Our existence does not have a cosmic purpose, so why bring new beings into this valley of shadows?

Plato answered with a belief-defying myth about a demiurge who built the world out of imperfect materials and left us in charge to complete the job. The same idea is repeated, with variations, by Augustine of Hippo, Thomas Aquinas, George Berkeley, Gottfried Wilhelm Leibniz, and many others. So philosophers – and theologians – have been extremely interested in reproduction; and one of their main jobs has been to justify bringing new sufferers into existence.

Konrad Szocik: What, in your opinion, are the advantages of antinatalist philosophy? And can you imagine the possibility of antinatalist education? Or antinatalist counseling?

Matti Häyry: The only advantage of antinatalist philosophy – remember who you are talking to – is that it is the only one that recognizes the truth. There is no meaning. Meaningless future suffering is inevitable if new lives are brought into existence. Wake up, world! Open your eyes!

Mind you, I was just presenting my views in a philosophical research seminar in Helsinki and experienced a revelation of my own. The host, after some hesitation, accepted that philosophers create theoretical narratives, and that the point of these narratives is to enable the continuation of human existence. He saw this as a triumph, though. Philosophy is the thin blue line between antinatalist chaos and pronatalist normalcy. I was stunned. But I suppose you can see it that way, if you are adamant about the survival of humankind for now.

You ask about antinatalist education and counseling. Maybe, but it is early days yet. People are only just beginning to realize that reproduction is (the availability of contraception) and should be (the recognition of procreative autonomy) in their own hands and that there is a certain responsibility attached to that. Some of them are already questioning reproduction in a horrible

world like ours is or is becoming. Others are challenging traditional family models and lean towards adoption and childlessness. The future does hold promise for at least to a degree of antinatalism.

Konrad Szocik: Finally, I would like to ask you about the war in Ukraine. Can this war inspire some new philosophical and ethical reflections on, for example, human suffering, the fragility of life, unpredictability?

Matti Häyry: I think it would be terribly callous to think of the war in Ukraine as an opportunity for philosophical or moral growth. But this may be due to my antinatalist philosophy. I am more than a little allergic to the idea that suffering caused by dictatorial delusions of grandeur ennobles us collectively or individually.