Genetic Evolution Tournament

2024-12-18

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Preface

The Genetic Evolution Tournament (GET) is a Metaculus human judgment forecasting tournament established to generate forecasts and scenarios pertaining to the use of genetic and reproductive technologies on humans for treatment and enhancement.

Figure 1: From Wikipedia (2024-10-16): *Before the play begins, Kronos, the ruler of the pre-Olympian gods (the Titans), had been overthrown by an insurgency led by Zeus. In that revolt, Prometheus had sided with Zeus. As the new king, Zeus intended to destroy and replace humankind. Prometheus frustrated this plan, showing humans the use of fire, which Prometheus had stolen. Prometheus also taught humanity the arts. For these acts of defiance, Zeus intends to punish Prometheus by chaining him to a rock in the mountains of Scythia.*

1 About

This section comes directly from the repository's README…

> *The Genetic Evolution Tournament (GET) is a Metaculus human judgment forecasting tournament established to generate forecasts and scenarios pertaining to the use of human genetic and reproductive technologies for treatment and enhancement.*

Hosting

- GET is being hosted publicly on Metaculus.

Contact:

- Primary Administrator: (AFg6K7h4fhy2) + (@) + (proton) + (.) + (me)
- Secondary Administrator: (keystroke) + (@) + (duck) + (.) + (com)

On Feedback: All feedback is welcome; however, feedback that enhances

- (1) the accuracy of claims made in this tournament's questions (and other files)
- (2) the visibility and or utility of this tournament
- (3) other exact properties of the tournament (such as an additional question or an alteration in the structure)

is *particularly* desired.

1.1 Summary Introduction

- A Metaculus tournament.
- Focuses on human enhancement and treatment via genetic and reproduction technologies.
- Around 150 questions across 5 categories
  - Ethical, Legal, and Societal Implications
  - Technological Advancements and Clinical Applications
  - Regulatory and Policy Developments
  - Accessibility and Demographic Shifts
  - Healthcare and Insurance System Evolution
- At present, 15K USD in prizes
- Tentative end date of 2045

1.2 Extended Introduction

Disclaimer: *This description, which possibly contains inadequacies, is a minimally viable placeholder. Beyond the content detailing GET, there are many unsubstantiated claims. At some point, this tournament might be published as research, in which case the author will more strongly evidence claims regarding the landscape of current capabilities for human enhancement and treatment via genetic and reproductive means. GET questions often contain references to research literature, but these are far from comprehensive. The Extended Introduction section is liable to change.*

Overview: *This introduction starts with some motivating remarks on possible future(s) for human reproduction and human genetic constitution. Following this, the author briefly describes GET, which is currently under development and due to be released on Metaculus (as a public tournament).*

Scientific progress in genetics, genetic engineering, and assisted-reproduction continues at a rapid and accelerating pace, with current technological capabilities far exceeding those imagined by researchers and policy-makers in biotechnology at the start of the 21st century.

Frontier events in genetic engineering, such as the Jiankui He affair, have required all of humanity to consider scenarios and possibilities—ranging the gamut of expected value from fantastical to catastrophic—concerning the manipulation of human biology.

Although extreme-fidelity human gene modification (as in precisely exacting desired genetic outcomes) or, more broadly, modification of human biology at a caliber similar to what we might expect to be employed in *Brave New World* or *Gattaca*, is yet unrealized, developments in the aforementioned fields steer evermore towards this capacity.

Fortunately, considerable anticipatory work in ethics and governance have coincided with scientific and technological progress in genetic and reproductive research fronts. Ethical work on directed use of technology on human biology has involved some degree of implicit and or explicit scenario analysis, but this analysis (in the author's sampling of the literature) has infrequently employed forecasting.

Handling anticipatory blind spots and reducing uncertainty on futures involving humanity's possible genetic evolution via forecasting seems important for coordination between researchers, the public, and policy-makers in directing outcomes and safeguarding certain aspects of humanity's future.

Despite the expected outcome for GET being that most community traction will occur within the Effective Altruism, Less Wrong, and Metaculus communities, GET seeks to occupy the general niche of uncertainty reduction on futures involving varying levels of human-targeted DNA and assisted-reproduction technologies.

GET will ideally contribute, via the forecasts collected across its lifespan, to a broader scenario modelling effort occurring across discussions on the future(s) of human genetics and reproduction. These forecasts and their analysis might inform individual and policy decision-making on the technologies and procedures involved in human genetics and reproduction.

With respect to the forecasting platform for GET, given both Metaculus's status as a reputable human judgement forecast (HJF) aggregator (this is the author's impression) and the author's familiarity with the site (the author is biased in this way), Metaculus was chosen as the site to host GET. The particular language and norms adopted in public tournaments on Metaculus typically incentivize forecasters to make clear and well-reasoned comments and to forecast as honestly and as accurately as possible. For example Metaculus tournaments, see this page.

GET currently consists of 5 question categories:

- (1) Ethical, Legal, and Societal Implications
- (2) Technological Advancements and Clinical Applications
- (3) Regulatory and Policy Developments
- (4) Accessibility and Demographic Shifts
- (5) Healthcare and Insurance System Evolution

Each category was intended to have between 15 and 25 questions; the intention was to between 75 to 125 questions in total.

To incentivize forecaster participation, there are prizes totaling 15K USD, though this may increase in the future. Prizes are partitioned into a forecasting accuracy component, with questions scored via Metaculus's default scoring procedures (peer scores), and a commenting component.

Originally, within the commenting component, 2.5k USD was allocated to comments on questions that are part of the forecasting accuracy component (shorter-term questions) and 7.5k USD was allocated to comments on longer-term questions. However, after some deliberation, a decision was made to break the commenting section of the tournament into 3 stages, each with 2k USD. The tournament is expect to last roughly 20 years. There is the possibility for additional funding altering the structure of the tournament.

2 Goals

GET has, broadly, the following goals:

- Generate questions on possible **civilizational impacts** of current and near term human genetic and reproductive technologies.
- Generate probabilistic **human-judgment forecasts** on the questions in the previous point.
- Synthesize the probabilistic forecasts in the previous point to make **quantitative statements on possible futures** (scenarios) for humanity involving the use of human genetic and reproductive technologies, with an emphasis on human enhancement.
- Communicate the questions, forecasts, and statements in previous points via Internet posts and or **publication(s)**.

Administrators of GET seek to achieve these goals by:

...Section pending, as this depends on the existence of forecasts and the feedback of experts and forecasters

3 Hosting

GET is publicly hosted on Metaculus:

- Metaculus GET Page: https://www.metaculus.com/tournament/genetic/?

GET also has a GitHub page and a website:

- GET Website: https://genetictournament.com/
- GET GitHub Page: https://github.com/AFg6K7h4fhy2/Genetic-Evolution-Tournament

4 Administration

GET is administered by:

- H559 (primary administrator)
- James Evans (secondary administrator)

Administration includes:

- Answering participants' questions about GET.
- Resolving GET forecasting questions on Metaculus.
- Allocating prize funds to GET prize holders.
- Continuing the tournament if Metaculus ceases to exist.
- Writing new questions and updating existing questions.
- Announcement of GET launch and new stages.
- Analysis and communication of forecasts produced.

To contact administrators directly:

- Primary Administrator: (AFg6K7h4fhy2) + (@) + (proton) + (.) + (me)
- Secondary Administrator: (keystroke) + (@) + (duck) + (.) + (com)

5 Contact

To contact administrators directly:

- Primary Administrator: (AFg6K7h4fhy2) + (@) + (proton) + (.) + (me)
- Secondary Administrator: (keystroke) + (@) + (duck) + (.) + (com)

6 Structure

Overview: *The author first explains how GET is set up, temporally speaking. Next, the author explains the size of GET's prize pool. The author closes with considerations for how these aforementioned topics may change.*

Disclaimer: *If this disclaimer is present, then the below sections are still being developed. Suggestions here would very much be appreciated. Please either make an issue here, contact the author, or fill out this form.*

GET is set up in stages:

- Tournament releases early 2025, estimate January 15th.
- *Short-Term Insights* section begins 2025-01-15, lasts until 2029-12-31.
- *Medium-Term Insights* section begins 2030-01-01, lasts until 2034-12-31.
- *Long-Term Insights* section begins 2035-01-01, lasts until 2045-01-01.
- Questions that do not resolve before 2045-01-01 are removed tournament scoring, but not from Metaculus.

Notes on the stages:

- GET is expected to initially have around 150 questions across 5 categories.
- Future questions will likely be added, especially as need arises[1].
- Different questions have different hidden[2] periods, based on their close dates.
- (critical) Questions belong to the stage in which they resolve or close.

Prize structure:

- GET is currently (2024-11-21) funded at PRIZE = 15K USD.
- The prize pool might increase at some point in the future.
- All stages have a commenting prize pool of 2/15 x PRIZE.
- All stages have 10 commenting prizes.
- Awardable comment periods:

[1] For example, new technologies or questions conditional on other questions resolving.

[2] A hidden period on Metaculus is when the Community Forecast is not visible to forecasters. This allows for non-autocorrelated forecasting for at least some period of the question.

  - *Short-Term Insights*: [2025-01-01, 2027-12-31]
  - *Medium-Term Insights*: [2025-01-01, 2032-12-31]
  - *Long-Term Insights*: [2025-01-01, 2032-12-31]

- Awards for comments in each stage are awarded at the end of the stage.
- Forecasting accuracy prize percentages by stage:

  - *Short-Term Insights*: 3.25/15 x PRIZE
  - *Medium-Term Insights*: 2.5/15 x PRIZE
  - *Long-Term Insights*: 1.75/15 x PRIZE

- Forecasting accuracy awards for each stage are also awarded at the end of the stage; these awards cover questions that resolved early i.e. before the stage that contained their close date.
- Conditional on certain questions resolving ambiguously within a stage, some such questions might be created again for a later stage, should the community generally express interest in this.

Prize restrictions:

- No one participant may receive greater than 1K USD in commenting prizes.
- Commenting prizes will only be distributed within a stage conditional on there being at least 5 comments.
- Commenting prize money not allocated with a stage will be
- Administrators may not receive prizes on comments but may receive forecasting accuracy prizes.

Comment award criteria[3]:

- The comment pertains to correct time horizons
- The comment is well-reasoned and clearly written
- The comment provides valuable information and reasoning
- The comment identifies mistakes in the community's reasoning or clearly explains why the author's forecast differs from the community's
- The comment describes connections between forecasts on different question groups, or inconsistencies between forecasts on different question groups

[3]At present, the author is deferred to the criteria used in the OWID tournament, which is, to some degree, qualitative.

7 Scoring

For GET commenting prizes:

- Evaluated by tournament administrators.
- Final commenting prize selections *may* be reviewed additionally by Metaculus administrators.
  - Should this occur, public notice will be provided.

For GET forecast scoring prizes:

- Metaculus scoring algorithms will be used.
- For information on Metaculus scoring, click here.

8 External Considerations

Concerning catastrophe:

> Should humanity go extinct* or experience a catastrophe* that results in the collapse of complex society* for over a continuous 5 year interval, all questions in the *Genetic Evolution Tournament* resolve as **Ambiguous**.

Concerning the non-existence of Metaculus:

- GET administrators will self-host the 2024-2025 open-source version of Metaculus.

9 Feedback

To provide feedback, use one of the four avenues:

- GitHub Discussion Comment
- GitHub Issue
- Google Feedback Form
- Metaculus Discussion Comment

Part I

Q: Ethical, Legal, & Societal Implications

10 Introduction

11 When will the first law be enacted anywhere in the world that legally permits the genetic modification of the following human traits?

- Intelligence
- Longevity
- Height
- Eye Color
- Skin Color
- Physical Strength
- Disease Resistance
- Cardiovascular Health
- Metabolism
- Pain Tolerance
- Depression/Anxiety
- Visual Acuity
- Hair Color/Texture
- Resistance To Addiction
- Empathy
- Aggression
- Morality

11.1 Background Information

Any legal doctrine must be explicit permissive of the genetic modification.

11.1.1 Fine Print

11.2 Resolution Criteria

12 When will the next individual(s) be imprisoned for genetically modifying a person or people?

12.1 Background Information

12.1.1 Fine Print

12.2 Resolution Criteria

13 How many lawsuits will be filed in the United States against companies offering in-vitro fertilization (IVF) services that screen for the following traits by 2030?

14 How many lawsuits will be filed in the United States against companies offering in-vitro fertilization (IVF) services that screen for the following traits by 2050?

- Intelligence
- Longevity
- Height
- Eye Color
- Skin Color
- Physical Strength
- Disease Resistance
- Cardiovascular Health
- Metabolism
- Pain Tolerance
- Depression/Anxiety
- Visual Acuity
- Hair Color/Texture
- Resistance To Addiction
- Empathy
- Aggression
- Morality

14.1 Background Information

14.1.1 Fine Print

14.2 Resolution Criteria

15 How many humans globally will be prenatally genetically modified in the following years?

- 2030
- 2040
- 2050
- 2075
- 2100

15.1 Background Information

15.1.1 Fine Print

15.2 Resolution Criteria

16 When will the next individual(s) be fined or imprisoned for seeking to have their newborn genetically modified?

16.1 Background Information

16.1.1 Fine Print

16.2 Resolution Criteria

17 Which nations will have over 1000 genetically modified newborns by the year 2050?

18 Which nations will have over 1000 genetically modified newborns by the year 2040?

19 Which nations will have over 1000 genetically modified newborns by the year 2075?

20 Which nations will have over 1000 genetically modified newborns by the year 2100?

- Nations

20.1 Background Information

20.1.1 Fine Print

20.2 Resolution Criteria

21 Which nations will have over 5% of their newborns genetically modified by the year 2050?

22 Which nations will have over 5% genetically modified newborns by the year 2040?

23 Which nations will have over 5% genetically modified newborns by the year 2075?

24 Which nations will have over 5% genetically modified newborns by the year 2100?

* Nations

24.1 Background Information

24.1.1 Fine Print

24.2 Resolution Criteria

25 Income Inequality Between

- IVF Individual
- Genetically edited newborns

25.1 Background Information

25.1.1 Fine Print

25.2 Resolution Criteria

26 How many companies will there be offering IVF services in the United States in the following years?

26.1 Background Information

26.1.1 Fine Print

26.2 Resolution Criteria

27 How many companies will there be offering prenatal genetic modification services in the United States in the following years?

28 Revenue Totals In The Following Years For IVF Companies?

29 Revenue Totals In The Following Years For Polygenic Screening Companies?

30 Revenue Totals In The Following Years For IVF Companies?

31 What is average of IVF

32 What is average of Polygenic Screening

33 What is the cost average of using genetic modification services in the United States in 2020 US Inflation Adjusted USD.

33.1 Background Information

33.1.1 Fine Print

33.2 Resolution Criteria

Part II

Q: Technological Advancements & Clinical Applications

Part III

Q: Regulatory & Policy Developments

Part IV

Q: Accessibility & Demographic Shifts

Part V

Q: Healthcare & Insurance System Evolution

Part VI

Announcements

34 LW & EAF

35 Elsewhere

Part VII

Resources

36 Scholarly Articles

37 Books

The author, in working on this tournament, has found the following books useful. At some point, links might be added connecting the author's notes to these books.

37.1 Choosing Children: Genes, Disability, And Design

Link: https://academic.oup.com/book/11973

Citation:

> Glover, Jonathan. Choosing children: Genes, disability, and design. Oxford University Press, 2006.

Bibtex:

```
@book{glover2006choosing,
  title={Choosing children: Genes, disability, and design},
  author={Glover, Jonathan},
  year={2006},
  publisher={Oxford University Press}
}
```

37.2 Clinical ethics at the crossroads of genetic and reproductive technologies

Link: https://www.sciencedirect.com/book/9780443190452/clinical-ethics-at-the-crossroads-of-genetic-and-reproductive-technologies

Citation:

> Hostiuc, Sorin, ed. Clinical ethics at the crossroads of genetic and reproductive technologies. Elsevier, 2023.

Bibtex:

```
@book{hostiuc2023clinical,
  title={Clinical ethics at the crossroads of genetic and reproductive technologies},
  author={Hostiuc, Sorin},
  year={2023},
  publisher={Elsevier}
}
```

37.3 Creating Future People: The Ethics Of Genetic Enhancement

Link: https://library.oapen.org/handle/20.500.12657/58965

Citation:

> Anomaly, Jonathan. Creating future people: The ethics of genetic enhancement. Taylor & Francis, 2020.

Bibtex:

```
@book{anomaly2020creating,
  title={Creating future people: The ethics of genetic enhancement},
  author={Anomaly, Jonathan},
  year={2020},
  publisher={Taylor \& Francis}
}
```

37.4 Enhancing Human Capacities

Link: https://onlinelibrary.wiley.com/doi/book/10.1002/9781444393552

Citation:

> Savulescu, Julian, Ruud ter Meulen, and Guy Kahane. "Enhancing Human Capacities." (2011).

Bibtex:

```
@article{savulescu2011enhancing,
  title={Enhancing Human Capacities},
  author={Savulescu, Julian and ter Meulen, Ruud and Kahane, Guy},
  year={2011},
  publisher={Wiley Online Library}
}
```

37.5 The End Of Sex And The Future Of Human Reproduction

Link: https://www.hup.harvard.edu/books/9780674984011

Citation:

> Greely, Henry T. The end of sex and the future of human reproduction. Harvard University Press, 2016.

Bibtex:

```
@book{greely2016end,
  title={The end of sex and the future of human reproduction},
  author={Greely, Henry T},
  year={2016},
  publisher={Harvard University Press}
}
```

38 LW & EAF Posts

39 Wikipedia

Part VIII

Appendix

40 Frequently Asked Questions

40.1 Why Is This On GitHub?

- …will have Python code for analyzing Google Scholar and Trends signals on genetic and reproductive technologies.
- …involves versions, specifically for prize sequences and groups of questions that are released.
- …involves a website hosted via GitHub Pages.
- …operates by open source principles (open development).

41 Glossary

42 Trends

43 Additional Remarks

See here.

See here.