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ORIGINAL PAPER

Dating apps as tools for social engineering

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Abstract
In a bid to boost their below-replacement fertility levels, some countries, such as China, India, Iran, and Japan, have launched state-sponsored dating apps, with more potentially following. However, the use of dating apps as tools for social engineering has been largely neglected by political theorists and public policy experts. This article fills this gap. While acknowledging the risks and historical baggage of social engineering, the article provides a qualified defense of using these apps for three purposes: raising below-replacement birth rates, increasing social cohesion, and preventing certain genetic diseases.

Keywords Dating apps · Social engineering · Romantic relationships · Fertility rates · Social cohesion · Genetic diseases · Karl Popper

Introduction

Dating apps are smartphone programmes used for initiating contact with potential romantic partners or partners for casual sex. They differ from traditional dating websites in a number of ways, including the fact that they track people's geographical locations; contain user profiles that are predominantly picture-based rather than text-based; and require users to assess these profiles by either swiping left to indicate a disinterest or swiping right to signify an interest, whereby a reciprocal like allows the 'matched' pair to communicate through the in-app chat function. Within less than a decade, these applications have garnered significant popularity. For instance, nearly half of young adults in the United States, aged 18 to 29, report having been on dating apps (Pew Research Center, 2020). In the United Kingdom, it was observed that even prior to the onset of the COVID-19 pandemic, during which the utilization of online dating services surged (Meisenzahl, 2020), a greater proportion of relationships among individuals aged 18 to 35 were initiated through online means (23%) compared to those instigated within workplace settings (20%), through mutual acquaintances (19%), or within social venues such as bars, pubs, or clubs (17%) (Singleton, 2019), while in Germany, online dating became the norm after the pandemic (Brzoska & Keller, 2023). Given their already substantial and increasing popularity, it should come as no surprise that states with below-replacement fertility have started to take an interest in these apps. China, India, Iran and Japan now offer their own dating apps in a bid to help their citizens find partners to procreate with and ideally form large families (The Economist, 2019; Godbole, 2022; Hawkins, 2023; Reuters, 2021).

In light of these developments, it is important to address a question that, to the best of our knowledge, has not received any scholarly attention: Can dating apps be used as tools for social engineering in ways that are beneficial for society and morally responsible? Our answer will be that they can, but that there are various risks involved that should be considered, and in some cases actively guarded against. Specifically, our aim is threefold. Firstly, we seek to demonstrate that dating apps have the capacity to act as effective tools for social engineering. They can be utilized in diverse ways to achieve a broad spectrum of collective outcomes. Secondly, we intend to highlight the necessity for nuanced, context-sensitive analyses of such uses, as the means and outcomes of social engineering via dating apps can vary widely. They range from beneficial to harmful, from secure to risky, and from those that respect individual freedoms and human dignity to those that could be seen as unduly intrusive if

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not outright Orwellian, underscoring the need for political theorists and public policy experts to devote significantly more attention to these applications than they have thus far.[1] Thirdly, while recognizing the experimental and early-stage nature of this discourse, we offer a qualified defense of utilizing dating apps to further three valuable objectives, which are not necessarily exhaustive: raising birth rates in societies where these rates are currently well below replacement, preventing the spread of genetic diseases, and promoting social cohesion in societies where intergroup conflict is rife.

The remainder of this paper is structured as follows. We start by elucidating the concept of social engineering (Sect. "Social engineering and its discontents"). While acknowledging its troubled history and associated risks, we argue that a blanket opposition to social engineering may be both imprudent and morally irresponsible. Following this, we delineate various societal objectives that dating apps could help to achieve in one or more ways, before offering a qualified defense of the three forms of dating-mediated social engineering mentioned earlier, which involve their use in increasing fertility levels, preventing the propagation of particular genetic diseases, and fostering social cohesion (Sect. "Dating apps as tools for social engineering"). After countering four potential objections (Sect. "Objections and some rejoinders"), we conclude by highlighting promising directions for future research (Sect. "Conclusion and directions for future inquiry").

[1] This article contributes to the evolving discourse in social policy literature by engaging with key debates on the transformation of intimate relationships (e.g. Lewis, 2006), the risks inherent in online dating (e.g. Couch, Liamputtong and Pitts, 2012), and the innovative frontiers of digital social policy (e.g. Henman, 2022). By centering its analysis on the potential of dating apps to address social challenges, this paper not only broadens these discussions but also ventures into the relatively uncharted ethical and political aspects of online dating regulation. Within this framework, it is crucial to acknowledge five key publications that have significantly shaped our understanding of the field. Among these is work by Nader (2020), who argues that even when commercial dating app companies prohibit users from filtering potential matches based on ethnicity or race, the use of collaborative filtering algorithms may still result in ethnically and racially biased recommendations being presented to users. Another publication is by Lexie Unhjem et al. (2021), which explores the ethical considerations surrounding the utilization of dating apps by mental health professionals with a particular focus on in-app interactions with clients. The remaining contributions include a book chapter by Klincewicz et al. (2022), which discusses a variety of moral issues pertaining to the use of dating apps (but, importantly, not the one discussed within this article), including cyberviolence, online misogyny, and so-called "doomswiping"; and two articles by De Vries, which call for regulations on the sale of visibility-enhancing features within dating-apps (de Vries, 2023) and explore the merits and demerits of state-run dating apps (de Vries, 2024).

Social engineering and its discontents

Social engineering constitutes a strategy in policy-making that seeks to mold attitudes and social behaviors. Typically operating on a large scale and with a long-term vision, it often focuses on intimate aspects of life and can leverage a range of methods—from the use of persuasion to that of coercion—thereby embodying a form of vanguard politics. Social engineering has notoriously attracted criticism, chiefly because of its links to technocratic ideologies and its infamous historical instances, such as eugenic programs, the Soviet "New Man" concept, and the Nazi "Lebensborn" project, which serve as stark reminders of its potential for misuse (Scruton, 2007, p. 432). The encroachment upon personal life and the disregard for familial traditions have undoubtedly contributed to the tarnishing of social engineering's reputation (Morse, 1999). However, as Popper argued, social engineering should not be discarded too quickly and entirely, especially when considering its potential to address contemporary challenges in a responsible and ethical manner.

Popper vehemently criticized *holistic social planning* as the endeavor to remodel society as a whole according to a predetermined plan, often accompanied by centralization, suppression of dissent, and the use of violence (Popper, 1966a, pp. 158–62). Totalitarian regimes were chastised by Popper for utilizing holistic social planning to achieve morally objectionable objectives, like racial purity, through morally objectionable means, such as terror and mass manipulation. However, Popper's critique extended beyond totalitarian regimes to social engineering more broadly. He argued that even social engineers with well-intended aims often suffer from intellectual hubris. Believing that they can orchestrate societal outcomes on a grand scale, they are bound to encounter unintended consequences, often at the expense of eroding established accomplishments. The danger, using Albert O. Hirschman's (1991) formula, lies in "perversity, futility, jeopardy."

In Popper's view, the real pitfall lies in an inflated sense of rationalism that resists scrutiny and empirical evaluation. Abandoning the quest for an ultimate foundation of knowledge, Popper advocates for acknowledging the inherent fallibility of human reason. Drawing parallels with biological evolution, he views scientific progress as a problem-solving endeavor that employs a method of trial and error (Stelzer, 2016, p. 378).

Popper found common ground with contemporaries such as F.A. Hayek (2001) and Michael Oakeshott (1991) in their epistemological critiques of central planning. However, while the latter took their critique further by completely rejecting rationalism in politics –with Oakeshott quipping that Hayek's emphasis on avoiding planning still amounts to

a form of planning (Oakeshott, 1991, pp. 26–27)—Popper sought to carve out space for social engineering.[2]

Popper contended that social planning can be redeemed by aligning it with his advocated scientific method. It can be conceptualized as *piecemeal social engineering*, an evolutionary approach as opposed to a revolutionary one, that endorses a cautious, gradual process, equipped to handle unexpected developments along the way (Popper, 1961, p. 69). When freed from hasty, overzealous ambitions, this approach could operate under the guiding principles of individual freedom and personal autonomy, a minimal degree of coercion, the broadest possible state neutrality, democratic oversight to avoid power concentrations, and a diversity of opinions and ideas to stimulate criticism. In this way, social engineering could be made compatible with the open society ethos. Although it may not immediately realize the lofty ideals of achieving happiness and perfection on earth it could serve as a valuable tool for minimizing suffering (Popper, 1963, p. 174):

> "If we accept the theory of rationality as problem-solving plus criticism in institutional contexts, we may thus think about moral problems in terms of standards of rationality, of how to solve problems in specific contexts well, while critically examining both problems and solutions. We do not need to justify actions as right or wrong. We need to explain why some courses of action are better than others. In doing so we appeal to the frameworks we find at hand and/or we try to improve these frameworks." (Stelzer, 2016, p. 381)

While Popper's perspective has significantly contributed to the discourse on social engineering, his viewpoint was arguably overly pessimistic (Duff, 2005). His perspective, largely influenced by his experiences with totalitarian regimes, positioned state intervention as "a dangerous though necessary evil […] that should be limited to what is really necessary for the protection of freedom" (Popper 1966b: 130). As a consequence, he embraces a negative utilitarian standard for evaluating social engineering. However, we argue that to genuinely safeguard freedom, a more optimistic and proactive approach to policymaking is warranted. This is especially relevant in today's context of late modern capitalism, where an absence of state regulation does not result in an anarchic void but rather triggers the ascendancy of market forces. Furthermore, there is an increasing recognition that the antithesis of social engineering—an approach characterized by pragmatic short-termism—is a detrimental element in modern politics, and perhaps even an affliction to democratic politics itself (e.g. Jonas, 1979; Smith, 2021).

There are two additional aspects that merit attention. First, the emergence of the information age and advancements in technology have significantly enhanced the prospects of social engineering. The incorporation of tools like computers, AI technologies, and methods such as game theory and econometric modeling has broadened our capacity for societal planning (see already Bell, 1973, 488). These developments certainly present new potential dangers. Increased data availability and more efficient control mechanisms raise concerns about privacy and the risk of overreach by governing bodies, potentially threatening individual autonomy. Additionally, doubts about the reliability of some information persist. At the same time, however, these technological advancements hold the promise of designing more ethically guided and less invasive forms of social engineering, suggesting that such practices today could be implemented in ways that are both more effective and more respectful of individual rights than in the past. Nudging is a case in point. Although concerns about the impairing effects on individual autonomy remain, especially in digital contexts, scholars increasingly emphasize the possibility of impactful and permissible nudge interventions if certain conditions are met. These conditions include the transparent disclosure of nudges, respect for individuals' freedom of choice, and justifications oriented toward both individual (pro-self) and societal (pro-society) goals (Lembcke et al., 2019; Schmidt & Engelen, 2020).

Secondly, authoritarian regimes appear to be deploying social engineering techniques rather effectively, both in holistic and piecemeal forms. This observation is widely recognized among commentators from liberal democracies who acknowledge the capability of such governments to strategically prepare their societies for future challenges. A potent and time-tested example of the holistic type is Singapore's *Ethnic Integration Policy*, which seeks to cultivate a balanced representation of ethnic groups within housing districts, thereby fostering social cohesion (Singapore Government Agency, 1989). On the piecemeal front, a notable initiative is the United Arab Emirates' *Education Vision 2020*, which intends to transform the existing education system by encouraging critical thinking and creativity (Jones, 2015).

In sum, while the dangers of social engineering are real and well-documented, we believe that outright opposition to such engineering may be overly cautious and potentially imprudent. This is true especially when we consider (i) the daunting challenges facing humanity in the twenty-first century, of which the next section shows that several, including below-replacement fertility and increasing social fragmentation, can at least be partially addressed through dating app-mediated social engineering, and (ii) the fact that, as will become clearer later, recent technological advancements

[2] For a reconstruction of the conversation between Popper and Oakeshott on rationalism, see (Jacobs and Tregenza, 2014).

allow for more effective and freedom-respecting forms of social engineering.

Dating apps as tools for social engineering

Why think that, as we now want to propose, dating apps are a potent and promising novel means of social engineering? A first reason was mentioned in the introduction, namely that a large portion of early-stage dating has moved to these apps, whereby we saw that in countries such as the United Kingdom and Germany, more relationships are already established via these technologies than in traditional, off-line ways. A second reason is that who partners up with whom has far-reaching implications. In this section, we will show that it can have a marked influence on a range of important social phenomena, including fertility rates, societal polarization, and the prevalence of genetic diseases.

One way in which states can capitalize on the social engineering-potential of dating apps is by developing their own dating apps. This is what countries such as China, Japan, India and Iran have done, with Iran simultaneously creating a state-owned monopoly on dating-app services by banning all privately-owned competitors (Reuters, 2021). Another way is for them to influence the design and functioning of existing, commercially-owned dating apps,[3] for example by imposing regulations on the kinds of algorithms and filters that these apps may or should use. While we are unaware of real-life manifestations of this latter type of social engineering, the far-reaching opportunities offered by it make us believe that it is likely that this will happen within the coming years, if it does not already.

Whatever the exact ways in which dating apps are deployed for social engineering or will be in the future, it should be clear that, as with any form of social engineering (see the previous section), there are clear risks involved. For example, to create or consolidate an apartheid-like system, states could secretly use algorithms for their apps, or force commercially owned dating apps to use algorithms, that mitigate the chances that members of particular ethnic groups will mix. They might also end up misusing user-data, harvesting it to identify and impose penalties on individuals with sexual orientations deemed illegal, such as homosexual ones. However, as we will argue in the remainder of this article, it by no means follows from such dangers that no state should ever resort to dating-app-mediated forms of social engineering. The best way of showing this is to note how failing to engage in it may leave unchecked serious social problems that the inhabitants of certain countries are facing, to which we turn next.

Raising fertility rates

One formidable societal challenge has already led a few states, including Iran and Japan (The Economist, 2019; Reuters, 2021), to launch their own dating-apps, namely that of sub-replacement fertility. These countries are by no means the only ones that are currently failing to have enough births to sustain their respective populations. According to current estimates, no fewer than 81 countries currently do (United Nations, 2023), which raises a host of problems. Not only does population ageing have high economic costs due to the shrinking of the working population and the increased expenditure on aged care (Lucero-Prisno III et al., 2022), but it also has a tendency to reduce a country's military power (Eberstadt, 2019; Hendershot, 1973) and to put considerable strain on younger generations to provide informal care (Lindt et al., 2020).

In response, some might say that the problem of sub-replacement fertility can be addressed by increasing immigration, rendering procreation-centered strategies redundant. Yet, although this may be of considerable help for the destination countries, it is far from a silver bullet. Like most higher-income countries, many of the lower-income countries from which the immigrants tend to hail are experiencing population ageing (United Nations, 2020). Because of this, bringing over young workers from these societies will often lessen population decline in one place only to exacerbate it in another.[4] What is more, low-fertility countries are estimated to require such large numbers of immigrants to offset population ageing—for example, one influential UN report found that doing so by 2050 would require their post-1995 immigrants and their descendants to comprise between 59 per cent and 99 percent of their respective populations (United Nations, 2000; for a recent reasserting of these findings, see Craveiro et al., 2019)[5]—that exclusively relying on migration appears an incomplete strategy. Finally, it is a well-known fact that high levels of migration come with their own challenges, such as reduced levels of social trust and altruism among citizens, at least on the short run (Putnam, 2007; Dinesen, Schaeffer and Sønderskov, 2020).

[3] There are precedents for this. In California, Tinder was ordered by a court to stop charging users different fees based on age after an age-discrimination lawsuit was brought against the company (Vega, 2019). Additionally, Australia has recently introduced an industry code for dating apps aimed at protect users from harm and abuse, compliance with which could become mandatory in the future (Evans, 2024).

[4] Whereby countries who see large shares of their most skilled, and therefore potentially most productive, workers leave may end up paying a high economic price for such migration (Docquier and Rapoport, 2012).

[5] But see Marois et al. (2020) for a more optimistic take.

What these observations suggest is that it is socially, politically, and economically of great importance that states with sub-replacement fertility attempt to reverse or, insofar as this proves unfeasible, simply reduce the pace of population ageing, which dating apps can help them with. One option here would be for such states to develop, or ensure that other actors (e.g. non-profit private organizations) develop dating apps that give users a better chance of finding long term-romantic partners than commercially owned apps provide. For although certainly not all long-term romantic partners end up becoming parents and although parenting arrangements in countries such as the US are diversifying (Pearce et al., 2018), not being able to find the right partner or finding them at an age where it has become difficult, if not impossible, to conceive has been shown to be one major cause of involuntary childlessness in contemporary Western societies (e.g. Berrington, 2017; Stone, 2020).[6]

What is pertinent for present purposes is that creating apps that are more effective or efficient in enabling individuals to establish long-term relationships than existing commercial dating apps should not be too hard, given that there are good grounds for thinking that commercially-owned dating apps are suboptimal tools for finding lasting love (Klincewicz, Frank and Jane, 2022; de Vries, 2024). To appreciate this, notice that once dating app-users forge stable romantic relationships, they will generally delete their accounts and thereby reduce the revenue that the owner-companies generate through various sources, including the sale of premium membership fees; the sale of specific virtual items that dating-app companies claim aid users in their quest for love and/or hook ups such as visibility boosts and superlikes (de Vries, 2023; Tseng, 2022); the sale of (new) user data to third parties[7]; and the sale of advertising space. Additionally, membership attrition is likely to make their apps less attractive to both remaining and potential future users due to the shrinking user pool, which risks triggering a vicious cycle where member losses trigger further declines and reduce the number of new users. Given all this, we should not be surprised to learn that a subset of dating app companies have been found to deploy deceptive tactics to retain members and keep them engaged, for example by having chatbots or paid actors feign interests in users (Gieselmann & Rasch, 2021; Hu et al., 2021), or that many have (successfully)[8] made their platforms highly addictive by incorporating various forms of gamification (Bonilla-Zorita, Griffiths and Kuss, 2020; de Vries, 2023; Nader Forthcoming, 2024). Nor should we be surprised if it turns out, as Klincewicz, Frank and Jane (2022) and De Vries (2024) have argued is plausible considering the deleterious financial consequences of membership-losses just mentioned, that many of these companies are utilizing the vast amounts of personal data collected by them to gratuitously prolong people's search for stable romantic relationships at least up to a point,[9] for example by deliberately presenting users with profiles of individuals with whom they are unlikely to establish such relationships.

To be clear, our contention here is not just that states with below-replacement fertility may need to develop, or oversee the development of, dating apps that do not unnecessarily prolong the search for lasting love by making that search longer than it would be if users were presented with random profiles. We believe they might need to take a further step by introducing, or by ensuring that other actors (e.g., non-profit private organizations) introduce, dating apps that *actively facilitate the pursuit of lasting love*. Besides presenting users with profiles of individuals likely to be suitable long-term partners based on the available data, such active facilitation might require dating app-providers to do one or more of the following:

- allow users to indicate whether they want to have (additional) children and, if so, how many;
- allow users to search for partners who either want to have (additional) children or simply do not object to having them;
- allow users to search for partners who either desire large families or simply do not object to having such families[10];

[6] Other important causes include, but are not necessarily limited to, increases in women's education and participation in the labor market; reduced religiosity; advances in reproductive technologies; economic uncertainty; and unfavorable housing conditions (e.g. Kreyenfeld and Konietzka, 2017; Mills et al., 2011; Zabak et al., 2023).

[7] A 2020 report found that several of the most popular dating app companies, including Tinder, OKCupid, and Grinder, have been selling personal data of Android-users to other companies, which included information about, *inter alia,* users' real-time locations, political views, sexual orientations, and drug-use histories (Forbruker, 2020).

[8] For example, highly gamified apps such as Tinder and Badoo both indicate that their users typically spend around 90 min daily on their platforms, spread across 10 to 11 separate log-ins (Badoo, 2016; Thomas et al., 2023). Additionally, several surveys suggest that addiction to dating apps is becoming increasingly common (Eharmony, 2023).

[9] We say 'at least up to a point', given that these companies could lose credibility and revenue if no one ever succeeded in finding lasting love on their platforms. Still, the fact that it is clearly not in their interests for users to establish long-term relationships too quickly, coupled with the aforementioned evidence of deceptive tactics to increase user retention and engagement such as the use of chatbots, renders it highly probable that many of these apps are not optimized for fostering long-term relationships.

[10] Notice that in some, and possibly many, cases, the desire to have a large family with someone may arise only *after* people have their first or second child with a particular person. In such cases, the ability to filter for individuals with desires for large families might be less rel-

– present users with profiles of individuals with whom they are likely to realize any desires for establishing (small or large) families. This may not only require dating app algorithms to take people's fertility preferences into account, but also how compatible they are in terms of their psychological profiles, interests, and so on.[11]

As already alluded to, the reason why, in our view, (overseeing) the development of such dating apps is properly regarded as a state responsibility is that the interests of states align significantly better with those of users seeking long-term relationships than the interests of commercial dating app companies. Specifically, whereas commercial dating apps are likely to be financially harmed by optimizing their apps for the establishment of such relationships, we saw that societies seem to benefit from it. This is not only true of those with below-replacement fertility (see our earlier remarks), but also of societies struggling with e.g. housing shortages and high levels of chronic loneliness among their populations, which can take a heavy financial toll. For instance, in the UK, employers face an estimated yearly expense of £2.5 billion as a result of health problems associated with chronic loneliness (HM Government, 2018), while in the US, Medicare incurs an additional $134 annually for each socially isolated older adult compared to those who are socially connected (AARP Foundation, 2018).

Promoting social cohesion

Another significant social problem that dating apps might be able to address is political and social polarization. In many countries, divisions within the population have emerged or widened over recent decades that have overall detrimental effects on society. In the US, for instance, no less than 44% of Democrats and Democratic leaners now view the Republican Party very unfavorably and 45% of Republicans and Republican leaners view the Democratic Party very unfavorably, which represents a marked difference with the mid-1990s when these rates were below 20% for each group (Pew Research Center, 2019). Whereas moderate degrees of political polarization are often welcomed as signs of a politically engaged citizenry, such high degrees are widely regard as maladaptive, being conducive to political paralysis and ultimately to democratic backsliding (McCoy et al., 2018). Other forms of socially deleterious divisions are ethnic, religious, or cast-based in nature, such as those found in countries such as Northern Ireland, Belgium, Spain, Bosnia, Turkey, Cyprus, Lebanon, Israel, Iraq, India, Sri Lanka, Bangladesh, Burundi, Kenya, and South Africa (Kaufman, 2023). Yet, even when there is no outright conflict between groups, high levels of ethnic diversity often have detrimental effects by reducing social trust and altruism within society—effects that are costly as well as tricky to counteract and may take considerable time to resolve (Putnam, 2007; Dinesen, Schaeffer and Sønderskov, 2020).

Just as dating apps can be used to help address the challenge of sub-replacement fertility, we believe they may have the potential to help address these and other types of polarization by promoting marriages between members of opposing camps,[12] as intermarrying has been shown to be an effective way of defusing social divisions in various places, including former Yugoslavia, Kurdistan, and Northern Ireland (Akdoğan & Kuşdil, 2024; Lloyd & Robinson, 2011; Smits, 2010).[13] To do so, governments could ensure that such apps, whether state-owned or commercially-owned, do not allow users to filter for political orientation, ethnicity, religion, or caste (Bedi, 2015; Steuwer Forthcoming, 2024). (While relatively few Western dating apps still allow for ethnicity-based filtering,[14] with Grindr removing this option in 2020 (BBC, 2020), selecting for political orientation or religion remains possible on many of them, including Tinder and Bumble, as does—to the best of our knowledge—caste-based filtering on Indian dating apps such as Shaadi.com and Dil Mil (Luthria, 2021; Mahtani, 2020.) Additionally, they could prohibit collaborative filtering methods that disproportionately show users profiles from their own caste or from those with similar political, ethnic, or religious backgrounds (Nader, 2020), and potentially take it further still

Footnote 10 (continued)

evant for dating app-users, although being able to indicate that one is open to such a family could still be useful for them.

[11] Whereas it may seem as if these measures favor individuals with desires for (small or large) families and are thus unfair towards a segment of the population, it bears highlighting that those wishing to remain childless might also benefit from them. The reason is that they simultaneously reduce the probability that members of this group will encounter profiles of individuals whose fertility preferences conflict with their own. Likewise, those currently unsure as to whether they want children might benefit from said measures by being able to connect specifically with those who are unsure too, as well as with those open to dating someone with such uncertainty. (That said, even if our policy proposals were to favor those who desire families, we do not necessarily see this as a decisive argument against them, given the social and economic costs associated with fertility rates that fall significantly below replacement levels. For a more in-depth discussion of when policies with unequal impacts on citizens' ability to pursue their conception of the good are justified or not, see e.g. Barry (2002) and Patten, 2014).).

[12] Which in the US would counteract an growing aversion against politically mixed marriages. See Klofstad, McDermott and Hatemi (2013), Iyengar and Westwood (2015, pp. 691–2), and Huber and Malhotra (2017, pp. 278–80).

[13] But compare Rodríguez-García, Solana-Solana and Lubbers (2016) for a more pessimistic picture of the Spanish experience.

[14] For a criticism of this practice, see e.g. Bedi (2015).

by requiring these apps to increase the visibility of profiles from out-group members.[15]

Some might object to such measures on the grounds that they sacrifice marital stability and individual wellbeing for social cohesion. For example, they might question the wisdom of promoting interracial marriages based on the finding that, on average, such marriages are more likely to end in divorce than ones between members of the same racial group (Choi et al., 2022; Zhang & Van Hook, 2009).

One thing to say in response is that insofar as intermarrying reduces social tensions between the groups involved, as we saw it has been found to do in various places, this is likely to render such marriages more widely accepted and therefore more likely to survive even if there remain significant obstacles, such as possible cultural differences and selection for character traits among partners that are predictive of marriage failure (cf. Fu et al., 2001; Zhang & Van Hook, 2009). As such, it might be mistaken to treat any lower levels of stability among such marriages as fixed or unalterable. Another thing to say here is that when polarization is producing one or more of the societal harms mentioned earlier (i.e. low trust, low altruism, democratic backsliding, ethnic or religious strives), this can, and not rarely will, have high costs for almost every member of society, which makes it reasonable to trade off a certain elevated risk of marriage failure against the potential cohesion-promoting effects. This is true especially once we consider that one could start by encouraging pairings between individuals where one party straddles the divide between the two groups, as these relationships may be less prone to premature failure than those formed between individuals firmly rooted in opposing camps.

For example, in the US, the government might commence by using dating apps to promote marriages between independents and Republics and ones between independents and Democrats, which currently make up 17 percent of all marriages, before using them to attempt to increase the share of marriages between Republicans and Democrats, which currently make up a mere 4 percent of all marriages (Institute for Family Studies, 2020). Likewise, rather than going straight for trying to raise the portion of white-black marriages, governments might first try to increase the number of black-brown marriages and brown-white ones or ones between castes that are relatively close to each other.[16] To repeat and avoid misunderstanding, a viable, that is efficient and unobtrusive approach in our view might not be to actively promote heterogamy Instead, it could involve guiding individuals away from short-sighted and narrowly self-interested assumptions that homogamy serves their best interests or to prevent algorithms influencing user behavior accordingly without them even knowing it.

Preventing genetic diseases

Still another problem plaguing contemporary societies—albeit some more than others—for which dating apps can offer part of the solution concerns the prevalence of certain genetic diseases. In Iceland, which has one of the most genetically homogenous populations in the world with most of its inhabitants descending from a group of ninth century Viking settlers, there is an app—The Islendiga-App or the "App of Icelanders" that helps people to avoid accidental incest, which is one major cause of such diseases (Fareed & Afzal, 2017). Carrying the slogan "Bum the app before you bump in bed", the app warns Icelanders when the person they are about to have intercourse with is too closely related (AP, 2013). What is pertinent for our purposes is that dating apps, whether state-owned or commercially-owned, could be required to offer a similar feature when (i) apposite genetic information is available, and (ii) there is a significant risk of unintended inbreeding, as there has found to be in not just in Iceland but also in other geographically isolated places such as Sardinia, Basque County, and Newfoundland as well as among groups with cultural proclivities against marrying outsiders, such as Ashkenazi Jews, the Hutterites, and the Amish (Kristiansson et al., 2008).[17] More generally, such apps could be designed to warn users *whenever*, based on the available data, there is a significant risk of producing offspring with genetic diseases such as Cystic Fibrosis, Tay Sachs, Huntington's Disease, and Sickle Cell Disease (Setty et al., 2022), which can also happen when two unrelated individuals procreate even if the risk is higher when people are relatives.

Given the potentially severe consequences for the individuals involved, one could in certain contexts indeed ask whether it might, in some cases, be justified for governments to adopt even more restrictive measures, such as requiring

[15] Admittedly, since the facts underlying social disunity seem "softer" than the facts associated with issues like birth rates or genetic diseases (which we will discuss in the next subsection), there might be a higher risk of governments engaging in problematic forms of social engineering under the guise of promoting social cohesion. Nevertheless, the evidence for the harms caused by societal fragmentation, as discussed above, seems significant enough to justify considering social cohesion as a factor potentially worth promoting through dating app-mediated interventions.

[16] Of course, when making such attempts, it is important to be mindful of, and possibly guard against, potential risks, such as the fetishization or objectification of members of specific ethnic or racial groups, as highlighted by Zheng (2016; but see Kershnar, 2018, for a more favorable view on racial fetishes). Additionally, Sommer Degn (2024) warns of the unintended harms that members of marginalized groups might suffer when inclusion efforts overlook discrimination dynamics within dating practices and intimate relationships.

[17] Although it is worth noting that among the Amish, few are likely to sign up for dating apps anytime soon due to their opposition to modern technology.

dating apps to block users from viewing the profiles of those deemed, from a pathological perspective, as unsuitable partners with whom to have children. While this would undoubtedly involve a paternalistic limitation on individual autonomy, it is worth noting that many states already impose similar restrictions through incest laws, which prevent relatives from marrying or impose penalties on sexual relations between them. Such measures may primarily be motivated by social and ethical concerns, such as power imbalances within families, but often they also aim to reduce the probability of genetically risky intercourse.[18] This applies not only to individuals who may be too reckless to consider the consequences, but also to those who are aware of the risks yet lack the knowledge to use contraception correctly or the discipline to follow through due to low impulse control (Godiwala et al., 2016; Hylton-Kong et al., 2021; Wang et al., 2015).

Objections and some rejoinders

At this point, several objections to our defense of dating-app-mediated social engineering must be addressed. The first casts doubt on the effectiveness of such engineering insofar as it involves states developing their own dating apps. Given the large amounts of resources and expertise that are available to behemoths such as Tinder, it might be thought that state-sponsored dating platforms face an uphill battle vying for subscribers and would need to invest huge sums of money to be competitive in this area, which, the objection continues, is unlikely to happen.[19]

One immediate thing to notice about this objection is that its scope is limited. Since it does not challenge the utility of dating-app mediated social engineering involving states regulating commercial dating apps as discussed within the previous section, what it establishes at most is that there are certain forms of such engineering that should not be pursued. However, even the notion that states will (generally) be unable to compete with the dating-app market seems overly pessimistic. For one thing, the fact that many dating-app users are subscribed to multiple dating apps simultaneously suggests that a large portion of this group is open to diversifying their dating-app portfolio. For another, the potential for states to make their dating apps wholly freely available—as opposed to simply offering a freemium version under which users tend to be highly restricted in their ability see who liked them, filter for various traits, etc., which is what most commercial dating apps do to motivate users to start paying for their apps (Vágó, 2022)—could significantly lower the threshold for trial and adoption. Moreover, those seeking committed relationships are likely to find state-operated apps appealing for the reasons discussed in the penultimate section, namely that the objectives of such platforms align more closely with their goals than do those of profit-driven app-providers like Tinder, Bumble, and Badoo.

A second objection questions the effectiveness of specific types of social engineering. It asserts that dating apps, whether privately or state-operated, are inherently prone to perpetuating shorter, less committed relationships that ultimately lead to fewer children. This is due to their intrinsic design of inundating users with image-based profiles, thereby trapping them in a paradox of choice. According to this paradox, the overwhelming multitude of options inevitably sends people on an endless quest for the best, making it difficult to settle on long-term commitments (Schwartz, 2004; Shenoy, 2021). While this objection awaits empirical validation in the context of online dating, we believe it would not be an insurmountable obstacle even if proven true, as it mainly calls into question the design of the apps. Particularly, state-run services have the flexibility to diverge from Tinder's default setting, which has the average user swiping through more than 50 profiles per day. One alternative for a more effective app design could take cues from traditional matchmaking services, which present users with a limited number of profiles that have an exceptionally high compatibility rate based on their preferences. Alternatively, given that research indicates most people are willing to overlook even deal breakers when the prospect of a date becomes real (Park, 2019), states might consider incorporating elements of offline blind dating into their apps, allowing users to engage in conversation before ticking off preference checkboxes.

A third objection maintains that the proposed forms of dating-app mediated social engineering push people into certain kinds of relationships and thereby fail to respect their personal freedom. Although this concern deserves to be taken very seriously, it does not strike us as fatal. One reason for this is that measures requiring dating apps to simply allow certain forms of filtering (e.g. for people who wish to have families or large families specifically) do not restrict personal freedom. On the contrary, they expand it. Another is that algorithmic social engineering could be made contingent upon active user consent or passive acquiescence. For instance, legislation might mandate that users be offered the option to be preferentially matched with individuals who share specific family planning goals or that ethnic, religious or political group affiliations are hidden as filter options. Alternatively, such algorithmic choices could be set as defaults, allowing users the option to opt out. In this way, state

[18] In Germany, for instance, §173 of the Criminal Code (StGB) prohibits sexual intercourse between close relatives. In 2008, the Federal Constitutional Court explicitly rejected a constitutional complaint brought by two siblings, citing the 'particular risk of hereditary defects' (BVerfG 2008, para. 49 cc) as a key reason for the ruling.

[19] This application of the futility thesis can be extended to contexts where states have enacted bans on private apps. Iran is a case in point, as its dating app Hamdam not rarely has been the subject of mockery rather than genuine use, according to anecdotal evidence (Kiani, 2021).

intervention would resemble other forms of nudging, such as opt-in or opt-out organ donation programs (cf. Saunders, 2012).

What about more intrusive interventions under which dating-app users are presented with the socially desirable profiles whether they have (tacitly) agreed to this or not? Even such measures appear acceptable, if not morally required, under certain circumstances. For instance, if a society faces a high prevalence of genetic diseases, it seems not unjustifiable for states to mandate that dating-app algorithms filter out genetically ill-suited matches if users indicate family planning intentions. Likewise, there are good grounds for thinking that when an aging population poses a significant risk to economic prosperity and social stability, skewing algorithms to favor matches that are more likely to result in childbirth and/or the stable upbringing of children could be permissible even without explicit users' consent. While some liberals regard the intimate sphere as a realm where state interference should be (almost) nonexistent (Alexander, 2008), our assumption here is that, despite being of great importance, people's liberty in this domain is not the only important value and, accordingly, not a value that should be invariably prioritized (cf. Berlin, 2013). If correct, then given that the costs of prioritizing personal freedom will sometimes be very high, especially when it imperils a society's economic prosperity, stability, and/or public health, and given that even the more intrusive state interventions proposed here remain fairly modest in absolute terms (while they may reduce or eliminate the visibility of certain kinds of profiles, no one is being prevented from dating people of their own choosing), it becomes plausible to think that said interventions could sometimes be justified.

To further support this conclusion, we should add that the absence of state interventions does not imply the absence of external influences. As noted previously, individuals' choices in the dating sphere are already being significantly shaped by dating platforms, among other private actors. These platforms operate with market-driven incentives, which need not and, as we demonstrated in the previous section, often do not, align with the interests of love-seeking users. Accordingly, rather than *expanding* constraints on personal freedom, it looks like the proposed forms of dating app-mediated social engineering will in many cases simply *change* some of these constraints in ways that better serves the public's interests.

Still another consideration corroborating the notion that even the more intrusive forms of dating app-mediated social engineering discussed will sometimes be justified is that the goals discussed can, and not infrequently, will simultaneously support personal freedom in significant ways. For example, neglecting to address population aging is likely to place heavy caregiving responsibilities and/or increased workloads on younger generations to support pensions, restricting their freedom to live as they wish. Similarly, failing to address societal polarization may lead to freedom-restricting social unrest and divisions (consider, for instance, societies where walls are built to separate warring groups or where people's lives are regularly disturbed by intergroup violence), while the inability to prevent certain genetic diseases may lead to severe forms of suffering.

A fourth and final objection is that for states to develop their own dating apps or gain access to the user data of commercially-owned app providers might result in misuses of personal information. For example, illiberal states could exploit user data to identify individuals with sexual orientations considered illegal, potentially leading to punitive actions. While this concern is valid as well, and while this might constitute a good reason for not wanting illiberal states such as Iran to enter the dating-app sphere, we think there are precautionary measures that liberal states can take to bring such risks to an acceptable level. One might think here not just of the introduction of robust privacy laws, such as the EU's General Data Protection Regulation of 2018, but also of the introduction of transparency legislation that mandates the public disclosure and plain-language explanation of algorithms (cf. Kim & Routledge, 2022); the appointment of ombudsmen or external monitoring bodies charged with detecting and reporting abuses (cf. Reif, 2004); and the extension of legal safeguards to whistleblowers (cf. Ceva & Bocchiola, 2019). Even if such measures will never completely eliminate the risk of personal data being misused, they can significantly reduce it up to a point where the potential benefits of dating-app-mediated social engineering as discussed in the previous section – i.e. increased fertility rates, greater social cohesion, lower prevalence of genetic diseases – come to outweigh the dangers involved.[20]

Conclusion and directions for future inquiry

Taking stock, this study has accomplished three things. First, we have established that there is good reason to believe that dating apps can be powerful tools for social engineering. Second, we have demonstrated the need to assess the desirability of such engineering on a case-by-case basis, given that there can be considerable variations in terms of the expected benefits and costs or risks. Third, based on these findings, we have offered a qualified defense of leveraging dating apps to help address three distinct social problems, namely those of sub-replacement fertility, social polarization, and the spread of genetic diseases. In defending these forms of app-mediated social engineering, we showed that while there are always risks

[20] Of course, one can have reasonable disagreements as to exactly when this point is reached for each goal; rather than try to settle this issue here, which would take us too far afield, all we wish to suggest is that on any reasonable balancing of costs and benefits, such points will exist.

involved in such engineering that ought to be taken seriously, a laissez-faire approach where states refrain from involvement in the dating-app market is usually not a risk-free option either, as it might leave in place, if not exacerbate, problems that exact a high toll on individuals and society more broadly.

In light of these conclusions, a number of intricate questions beckon further inquiry: When, if ever, should specific states opt for developing their own dating platforms, oversee the development of new (socially beneficial) dating apps by third parties, and/or seek to influence the design of existing commercial dating apps? What mechanisms should be put in place to prevent abuses of user data? Should there be mandatory transparency requirements concerning the algorithms used by these apps, disclosed either to the general public or to a representative body? We hope that this contribution will inspire scholars to explore these and other pressing questions related to dating app-mediated social engineering.

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