

# Don't Worry, Be Happy: The Geography of Happiness on Facebook

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## ABSTRACT

Social media sites have been used to track the expression of emotion words across nations. A question left unexplored is whether, at a similar scale, these sites can be used to collect reliable well-being data. To tackle this question, we collect Satisfaction With Life (*SWL*) test results from a Facebook application and show that aggregate country-level results significantly vary across twelve rich countries and strongly correlate with official well-being scores. To then show that collecting data on Facebook offers an informative look at the sociology of well-being, we study the impact of (un)happiness on the twelve countries by relating the test results on Facebook to reputable international indicators of social and health problems. We find that countries where happiness is lower have increased problems across the board: decreasing well-being is associated with increasing homicide, obesity, drug use, mental illness, and anxiety. In addition to offering these findings, this work hints at the conditions under which social media could be used for data-driven social science research.

## ACM Classification Keywords

H.4 Information Systems Applications: Miscellaneous

## General Terms

Measurements, Verification

## Author Keywords

Psychology, geography, quantitative methods, Facebook, statistics

## INTRODUCTION

For a long time the best way of improving the quality of human life has been economic growth. The good news is that as growth increases so does happiness. The bad news is that happiness increases up to a point - only during the early stages of economic development - after which a process of diminishing returns kicks in: the richer a country gets, the less still getting richer adds to happiness [17]. It seems that rich countries have reached a threshold of material living standards,

and economic growth has largely finished to contribute to the happiness of their citizens. So, in policy circles, the question of “what makes people happy” has recently become popular [28]. To answer that question, one should be able to measure happiness (also called “well-being” in academic circles).

The most common way to find out whether people are happy in general is to survey individuals in a random sample of households and ask them question such as “Taking all things together, would you say you are very happy, quite happy, or not very happy?”. To make sure that respondents use the words in the same way, replies are independently verified by asking friends or colleagues of each individual to rate the person’s happiness. These independent ratings are generally strongly related to the way people rate themselves [5]. One common test is called Satisfaction With Life (*SWL*): its score effectively reflects the extent to which a person feels that his/her life is worthwhile [3, 4]. However, administering it to entire countries is costly and, as such, it is generally administered to limited population samples at a frequency of years. To ameliorate costing and temporal resolution problems, previous work has suggested the use of social media platforms to administer this test. Kramer has, for example, administered it to 1,341 users and found that test results weakly correlate with the use of emotion words ( $r = .17$ ) [14].

Here we set out to study whether one could administer the *SWL* test at a larger scale, and to which extent the resulting data would be of good quality. More specifically, our main contribution is to test whether *SWL* results collected from a Facebook application allows for reliable geographic sociological studies. We do so by collecting test results for 32,787 users in twelve rich countries. We study whether such data correlates well with official *SWL* data (Section “Facebook *SWL*”), and whether the relationship between *SWL* and social problems is consistent with what one would expect from the literature (Section “Sociology of Happiness”). We find strong correlations suggesting that, in happier countries, women enjoy higher status, democratic institutions work better, and people trust each other. In Section “Discussion”, we will discuss theoretical and practical implications of this work.

## RELATED WORK

In his book “Happiness: Lessons from a New Science”, Richard Layard focused on the paradox that most people want more income, yet as societies become richer, they do not become happier [17]. To explain this paradox, he reviewed research on what determines human happiness: the role genes play in happiness, what activities make us happy, which coun-

tries are happiest, how stable happiness has been in the U.S. in the last fifty years (even as average incomes have more than doubled), and how jealousy of the income of our peers impacts our happiness. As for geographic studies, in their Science paper, Oswald and Wu tested whether self-rated happiness answers are correlated with where people choose to live in the US [20]. They found that the average happiness is high in States that have characteristics that are objectively pleasant (i.e., that have high index of state-by-state quality of life).

One common factor links the healthiest and happiest societies: the degree of income equality among their members. In their book “The Spirit Level”, Richard Wilkinson and Kate Pickett shows that income gap between a nation’s richest and poorest is the most powerful indicator of a functioning and healthy society [31]. Poor health, violence, lack of community life, teen pregnancy, mental illness are all more likely to occur in unequal societies, and happier societies tend to be more equal.

Since it is important to measure happiness across countries but there is a significant financial cost involved in collecting self-reported happiness answers, Kramer decided to administer the SWL test to 1,341 Facebook users and compared the results with each individual’s use of words [14]. He found that the difference between the number of positive and negative words weakly correlated with self-reported happiness ( $r = 0.17$ ). More recently, he also found that Facebook users *influence* each other in the use of emotion words in their status updates [15].

There has been little *validation work* showing whether social media can be used to perform reliable geographic well-being studies. An effective way of ascertain that is to carry out one such study upon Facebook data; we do so next.

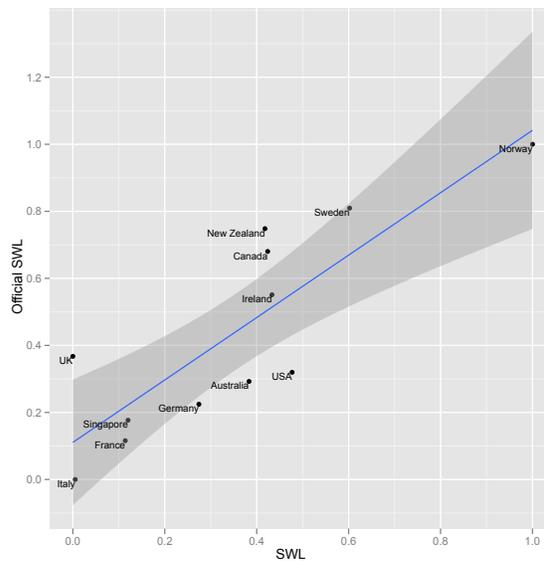
## SETS OF DATA

This work combines our Facebook data with socioeconomic data coming from reputable international organizations.

**Facebook Data.** The Facebook application of myPersonality that has allowed more than six million Facebook users to take a variety of genuine personality and ability tests<sup>1</sup> [13, 25, 26]. Users are not paid and are solely motivated by the prospect of receiving reliable personality test results. The application ensures high test result validity by removing the protocols that may be a product of inattentive, language incompetent, or randomly responding individuals. One of the tests offered by the application is the SWL test, and 107,035 users have voluntarily taken it. For 40,720 of them, we also know the countries where they live<sup>2</sup> and, consequently, we aggregate their test scores creating a unique mean test score for each country. Figure 1(a) maps such countries, and intensity is proportional to the logarithm of number of test takers. Despite the wide geographic spread, statistically reliable results are only available for 32,787 test takers in 12 countries: Australia, Canada,

<sup>1</sup><http://www.mypersonality.org/wiki/>

<sup>2</sup>We do not have their textual comments and cannot do any textual analysis.



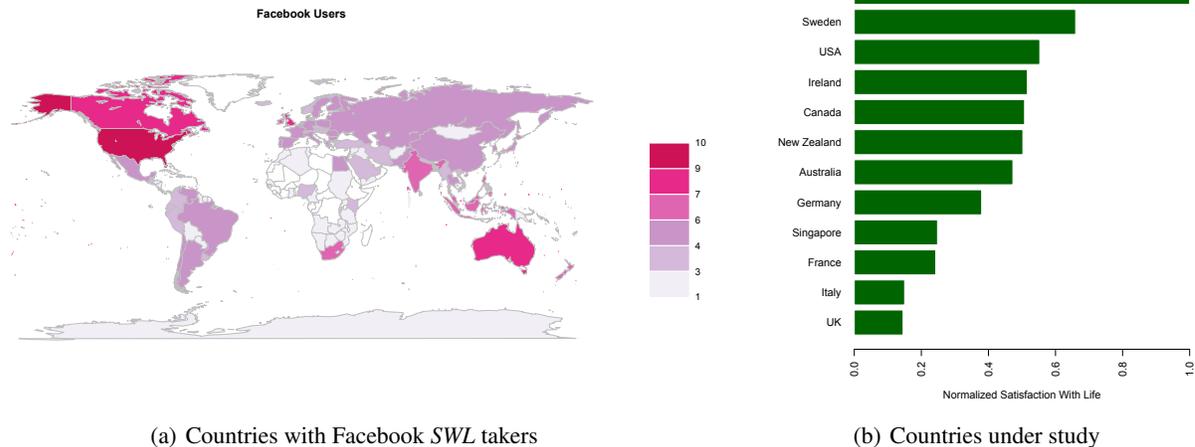
**Figure 2. Normalized SWL indicator from official source vs. that from Facebook. They are strongly correlated.**

France, Germany, Ireland, Italy, New Zealand, Norway, Singapore, Sweden, UK, USA. Next, we will discuss how these countries differ from those left out.

**Socioeconomic Data.** A list of countries that would be potentially possible to compare would initially include the 50 richest countries in the world, exclude countries with populations below 3 million (to avoid tax havens) and countries without comparable data. That list would result in 23 countries for which data about a set of health and social problems like violence, mental illness, teenage births and educational failure is available. Out of the 23 countries, we have reliable SWL data for 12 of them. One might then wonder whether there is any difference between these 12 countries and the 11 left out (which include Greece, Belgium, Spain). We rank countries in the two sets by number of Facebook users and compute the geometric averages of the ranks in the first set and in the second set (the higher the rank, the lower the total number of Facebook users) - the geometric average is 16.68 for the set of 12 countries, while it is 36.64 for those excluded, suggesting that countries for which we have reliable SWL data are those with a considerable number of Facebook users. Therefore, it seems that having comparable cross-country data depends on Facebook’s penetration rates. But, after reaching a certain penetration rate, is the resulting data of good quality? Or is its quality still dependent on penetration rates? We will answer these questions next.

## FACEBOOK SWL

There are a variety of different methodologies being used to produce official data about happiness across countries. One measure comparable with our aggregate SWL mean score is provided by the World Database of Happiness [29]. This database contains the average level of well-being in a given country and is obtained from self-reported happiness an-



**Figure 1.** Countries in our set of data: (a) those with SWL takers on Facebook (intensity on the map is proportional to the logarithm of users in each country); and (b) those with a considerable number of test takers.

swers. We take the mean score produced in 2009 and compare it with the mean score of our Facebook users: their correlation is strong ( $r = 0.82, p < 0.001$ ), and their relationship is plotted in Figure 2. Scores are normalized to enable an overall comparison on the basis of  $Normalized\ SWL = \frac{SWL - \min(SWL)}{\max(SWL) - \min(SWL)}$ , where  $\min(SWL)$  and  $\max(SWL)$  are, respectively, the lowest and highest values for SWL mean score. The narrow scattering of points means that one is an excellent predictor of the other. These countries include few with Facebook’s SWL mean score slightly higher than the official’s (e.g., USA), and few slightly lower (e.g., New Zealand, Canada). Those are small differences and do not impact the ranking of those countries. However, we perform two further robustness checks. First, we test whether the number of users in our sample is larger in countries with higher Internet’s penetration rate. We correlate the Internet Use statistics<sup>3</sup> and the number of users in our sample and find no statistical significant correlation ( $r = 0.09$  at  $p$ -level 0.05). Second, we test whether the squared differences (a measure of error) between Facebook’s SWL scores and official’s is related to the use of the Internet. We find no significant correlation, suggesting that discrepancies between the two SWL mean scores in a country do not depend on the country’s Internet penetration rate.

### SOCIOLOGY OF HAPPINESS

Being strongly correlated with the official’s, the Facebook’s mean scores seem to be suitable for further analysis. To ascertain their quality, we relate them to a wide range of social and health problems. The more consistent those relationships are with, say, what one would expect from the literature, the more reliable those scores are.

For each social and health problem, we offer two types of evidence. First, we graph each relationship between any given

problem and happiness by putting happiness along the horizontal line at the bottom (the  $x$ -axis), so societies with low levels of happiness are to the left, and societies with high levels of happiness are towards the right of the graph. The different health and social problems are shown on the vertical line (the  $y$ -axis) on the left side of the graph. On each graph, there is a scatter of points of countries (one can see how each society compares to others), and a regression line (best fit for the trend through the data points). The second piece of evidence consists of the correlation coefficients and corresponding statistical significance, which reflect how unlikely it is that the pattern we see could result from chance alone. We report results only for the Pearson correlation coefficients (which assume normal distributions and linearity), as the use of non-parametric Spearman rank correlations has produced very similar results.

For convenience, the health and social problems are collated in Tables 1 and 2. Each table reports two key pieces of information: the source from which each indicator has been taken, and the correlations between the indicator and the two SWL mean scores.

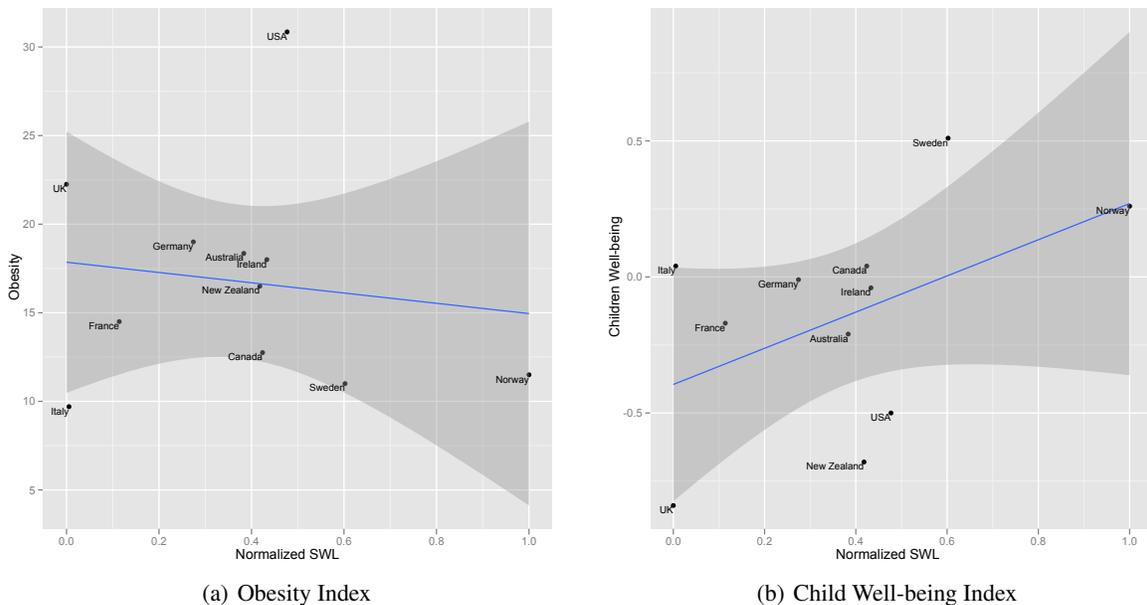
### Food and Illegal Drug Consumption

Obesity is increasing rapidly throughout the developed world. In some countries rates have doubled in just a few years. In the UK, two-thirds of adults are overweight and more than a fifth are obese. We decided to test whether well-being is associated with increased rates of obesity and to look at associations with one of its causes - higher calorie consumption. Data on calorie intake per capita per day is made available by the Organisation for Economic Co-operation and Development (OECD) Health Database. We find that per capita calorie intake is lower in happier countries ( $r = -.23$  for calorie intake). Since eating a lot might lead to obesity, we then take data on the proportion of the male and female population who are obese ( $BMI \geq .30$ ). This data comes from the International Obesity TaskForce, an organisation of the International Association for the Study of Obesity. We find that

<sup>3</sup>[http://en.wikipedia.org/wiki/Global\\_Internet\\_usage](http://en.wikipedia.org/wiki/Global_Internet_usage)

Indicator	Facebook SWL	Official SWL	Source
<b>Food and Illegal Drug Consumption</b>			
Calorie Intake	-0.23	-0.30	OECD Health Database
Obesity	-0.14	-0.26	International Obesity TaskForce
Child overweight	-0.08	-0.09	International Obesity TaskForce
Drugs Index	-0.29	-0.26	UN World Drug Report
<b>Education</b>			
Literacy Scores	0.26	0.58	OECD PISA
Public Health Expenditure	0.25	0.30	The World Bank
Children Well-being	0.48	0.38	Unicef Index
<b>Sustainability</b>			
Recycling	-0.47	-0.47	Australia's Planet Ark Foundation
Peace Index	-0.40	-0.56	Global Peace Index
Foreign Aid	0.59	0.63	OECD Foreign Development
Patents	0.64	0.60	World Intellectual Property Organization

**Table 1.** List of indicators of problems related to food and illegal drug consumption, education, and sustainability. Their Pearson correlation coefficients with SWL scores (all statistically significant) are shown in the second and third columns. To ease reproducibility, the sources from which the indicators have been taken are also reported.



**Figure 3.** Problems about food and education are (weakly) related to happiness in rich countries.

per obesity is lower in happier countries but the correlations are very weak ( $r = -.14$  for (adult) obesity and  $r = -.09$  for overweight children). Figure 3(a) graphs this relationship and shows that an outlier stands out. Obesity is so high in USA that it cannot be explained by well-being only. By contrast, in the other countries, the relationship unfolds as we have hypothesized - lower level of obesity in happier countries.

Since the relationship of happiness with obesity is slightly weaker than that with calorie intake, obesity only partly explains greater calorie intake in unhappy countries. Research has shown that people seem to respond to food in different

ways depending on how well they feel or, conversely, how stress they are. The body's stress reaction not only causes people to put on weight, but also causes a pattern known as *stress-eating* or *eating for comfort*. In experimental settings, when rats are stressed they eat more sugar and fat. In a study in Finland, stressed people ate more sausages, hamburgers, pizza and chocolate, and drank more alcohol than other people [16]. Stress eating seems to be a way to cope with situation of stress, and food stimulates the brains of chronic over-eaters in just the same ways that drugs stimulate the brains of addicts [9, 11, 12]. Stress-eating could partly explain the higher calorie intake in countries in which people enjoy lower

levels of well-being.

Finally, we look at consumption of illegal drugs. Unhappiness is painful to most people, so happier countries could consume less illegal drugs, such as cocaine, marijuana and heroin. The World Drug Report 2007, compiled by the United Nations Office on Drugs and Crime, contains the results of sample surveys on the prevalence of the use of opiates, cocaine, cannabis, ecstasy and amphetamines. Wilkinson and Pickett combined consumption of these drugs in one index. Correlating it with happiness, we find a tendency for drug abuse to be less common in happier countries ( $r = -.29$ ).

As for food and drug consumption, the picture is consistent with findings at individual level. Yet correlations are weak, suggesting that there are other factors that explain those consumption patterns. In section Discussion, we will discuss how income inequality relate to them.

### Education

Based on cross-sectional studies of individuals, research has shown that people with more education earn more and are happier [6]. To see if the educational performance of school children was related to living in happier countries, we resort to estimates of the combined maths and literacy scores for 15-year olds taken from the Programme for International Student Assessment 2003 (OECD Programme for International Student Assessment, 2004). The correlation coefficient of educational performance in relation to happiness is  $r = 0.26$ . That is partly because happier countries have high reading scores. Happiness affects family life and domestic relationships [10], and proving a stimulating social environment (essential for early learning) is harder for parents when they are unhappy, or stressed, or unsupported [10].

To go beyond test scores of children and look at behavior of young people more generally, we consider the Unicef index, which puts together 40 indicators of child well-being in rich countries based on six different aspects of child well-being. Material well-being reflects things like living in a home with few books or with unemployed adults; health and safety includes items like immunization rates and deaths from accidents; educational well-being included scores on performance tests and the proportion of children going into further education; peer and family relationships measures such things as whether or not children viewed their peers as kind, and the numbers of children living in single parent and step-parent families; behaviors and risks includes smoking and drinking, and how many children had sex by age 15; and, finally, subjective well-being includes self-rated health and other measures of how children felt about themselves. It turns out that the Unicef child well-being index is not related to average living standards in different countries, but, as Figure 3(b) shows, it is positively related to country happiness ( $r = 0.48$ ).

### Sustainability

Tackling big societal problems such as that of reducing carbon emissions depends on world co-operation, and pursuing short-term self-interest should be less preferable than a wider sense of social responsibility. To capture “social responsibility”, we look at how people behave within their own country,

and then how a country collectively behaves towards other countries.

*Within Countries.* Public responsibility might affect how people in rich countries respond to environmental issues. We consider data from Australia’s Planet Ark Foundation that ranks countries by the proportion of waste they recycle [21]. The correlation with happiness is positive ( $r = -0.47$ ) - happier countries tend to recycle more - even those with lower *GDP* (the correlation between recycling and *GDP* is lower  $r = -0.25$ ).

*Among Countries.* Public responsibility carries over into international relations. Greater happiness within the rich countries is associated with more helpful policies towards poorer countries. We consider the Global Peace Index (*GPI*) which reflects militarism and violence [30]. It includes internal factors such as levels of violence and crime within the country and factors in a country’s external relations such as military expenditure and wars. Nations considered more peaceful have lower index scores. The correlation with well-being is negative  $r = -0.40$ , suggesting that happier countries tend to be less militarist and violent. However, as Figure 4(a) shows, this is true for all our countries but USA, which performs so poorly on this index that its value cannot only be explained by the well-being of US citizens. We then consider whether the countries under study are generous to poorer countries by looking at the spending on foreign development registered by *OECD* [19] - happier countries spend higher percentages of their Gross National Income on aid to developing countries ( $r = 0.59$ ). The United Nations set a target for spending on foreign development aid (which 0.7% of Gross National Income), and only Sweden, Norway and the Netherlands meet (and are more generous than) that target.

Comparing behavior within countries and among countries has lead to consistent conclusions, and that is telling - it seems that what people learn about human relations in their own society establishes their basic assumptions about human nature which they then apply to the world at large.

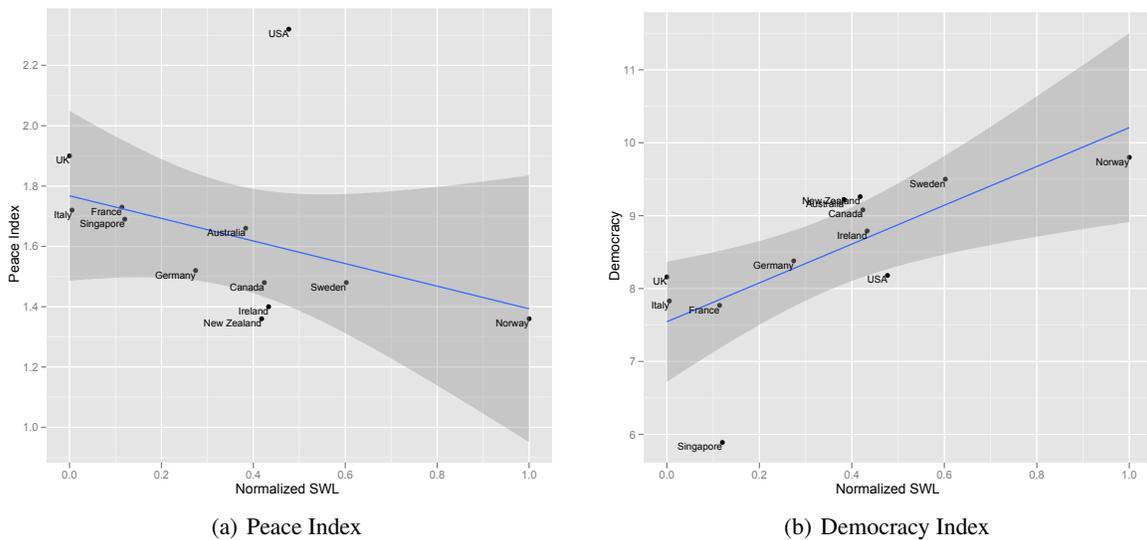
What is required for the development of sustainable communities is not only social responsibility but also highly adaptable and creative societies capable of generating the necessary innovation. So one might wonder whether happiness might be related to creativeness and innovation. We consider the number of patents granted per head of population for each country and find that happier societies achieve higher levels of patents per capita ( $r = .64$ ). That is because, as we have previously seen, they have higher levels of social mobility and of educational achievement and, as such, they waste less of their potential human capital.

### Democracy

How people behave with each other is also reflected in the functioning of their political system. That is why The Economist Intelligence Unit has put together an Index of Democracy, which reflects the state of democracy worldwide for 165 independent states and two territories, and the results for 2010 has been made available only recently. It is based

Indicator	Facebook SWL	Official SWL	Source
<b>Democracy</b>			
Democracy Index	0.72	0.69	The Economist Intelligence Unit
<b>Equal Opportunities</b>			
Social mobility	-0.57	-0.69	Blanden <i>et al.</i> [2]
Women's Status	0.80	0.74	Wilkinson and Pickett [31]
<b>Social Capital (Trust)</b>			
Trust	0.83	0.82	World Value Survey

**Table 2.** List of indicators of problems related to democracy, equal opportunities, and social capital. Their Pearson correlation coefficients with SWL scores (all statistically significant) are shown in the second and third columns. To ease reproducibility, the sources from which the indicators have been taken are also reported.



**Figure 4.** Militarism and problems with the functioning of democracy are far more prevalent in unhappy countries.

on five categories: electoral process and pluralism; civil liberties; the functioning of government; political participation; and political culture. Each country belongs to one of four types of regimes: full democracies; flawed democracies; hybrid regimes; and authoritarian regimes. The US and UK are near the bottom of the “full democracy” category. In the US, there has been an erosion of civil liberties related to the fight against terrorism, and problems in the functioning of government have also become more prominent. In the UK, there has been an exceptionally low level of political participation across all dimensions - voting turnout, membership of political parties and willingness to engage in and attitudes to political activity.

Although all our countries but Singapore were in the category “full democracies” in 2008, two of them - France and Italy - dropped from the category “flawed democracies”. In France, the downgrading resulted from various negative political trends. There has been a consistent decline in public confidence in political parties and the government; in citizens’ engagement with politics; in the degree of popular support

for democracy (one in seven do not agree that democracy is better than any other form of government). In Italy, instead, the media situation significantly contributed to the downgrading. In 2008, Silvio Berlusconi returned to power as prime minister and, in addition to owning and controlling three national television channels, he acquired indirect control over the three other channels of the state broadcaster.

Research has shown that there is an apparent association between the level of development (income per head) and democracy: the simple correlation between democracy index and the logarithm of *GDP* per head is under 0.60. Yet we found that the correlation with well-being is slightly higher - it is 0.72. Figure 4(b) plots the relationship and allows us to single out Singapore as an outlier where the democracy index is unusually low to be comparable to other rich countries. However, the relationships for the other rich countries is clear: happier ones tend to respect not only basic political freedoms and civil liberties, but also have a political culture conducive to the flourishing of democracy: the functioning of government is satisfactory; media are independent and di-

verse; and the judiciary is independent and judicial decisions are enforced.

### Equal Opportunities

Unhappy people distrust other people [24]. That increases social class differentiation and perhaps prejudice and may make it harder to achieve equality of opportunity. One way to quantify equal opportunities between the haves and the have-nots is to measure social mobility, that is, to measure whether the incomes of parents and their children are correlated - do children of poor parents stay poor? Higher correlations indicate less social mobility. Blanden and colleagues estimated the correlation between father's and son's incomes (when sons were close to age 30) for a large, representative cohort studies in each of eight countries [2]. We take their intergenerational social mobility index and correlate it with country's well-being and, despite having data for only eight countries, the relationship is statistically significant ( $r = -0.69$ ): among these eight countries, bigger income differences are associated with lower social mobility.

In addition to wealth, equal opportunities are often associated with gender differences. Improvements in women's status may depend on the development of a gentler society, less dominated by a macho culture. To test the relationship between happiness and women's status, we take the women's status index, which combines measures such as percentage of women in the legislature, the male-female income gap, and the percentage of women completing higher education. We find that there is a strong tendency for women's status to be better in happier countries ( $r = .80$  and Figure 5(a)).

### Social Capital (Trust)

Governments and policy makers are increasingly interested in "social capital" or social cohesion, trust, and involvement in community life. These are an important part of the quality of life and make a difference to what a society feels like to live in. Trust is the foundation of most personal relationships, which in turn are key determinants of human well-being and economic development. Theoretical and empirical analysis shows that high levels of interpersonal trust make many aspects of life more enjoyable and productive. The World Values Survey (WVS) is the most commonly used cross-country survey to measure interpersonal trust. The WVS measures interpersonal trust relying on the question: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?". The main indicator resulting from the question is the percentage of people who reply "most people can be trusted". Levels of interpersonal trust are very different from country to country. People in Norway, Sweden and Denmark report the highest levels of trust in other people (more than 60% of interviewed answered that most of people can be trusted), while the lowest level of trust is seen in Portugal. Just within the rich market democracies there are at least five-fold differences in levels of trust, and researchers have shown repeatedly that trust is linked to health and well-being. Upon our data, these findings are confirmed - the correlation between trust and happiness is strong ( $r = 0.83$ ). Communities are more cohesive and people trust

	<b>Model 1</b> <i>SWL</i>	<b>Model 2</b> <i>GDP</i>	<b>Model 3</b> <i>inequality</i>	<b>Model 4</b> <i>SWL+GDP</i>	<b>Model 5</b> <i>SWL+GDP+inequality</i>
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Obesity	2%	6%	<b>54%</b>	32%	62%
Child well-being	23%	25%	<b>64%</b>	26%	65%
Peace	15%	8%	<b>37%</b>	28%	38%

Democracy	<b>51%</b>	21%	49%	56%	73%
Women's status	<b>63%</b>	37%	39%	64%	70%
Trust	<b>69%</b>	36%	49%	71%	80%

**Table 3. Predictive power ( $R^2$  in %) of different linear regression models (first row) for a set of social problems (first column). Inequality explains better obesity, children well-being, and militarism, while happiness explains better functioning of democracy, women's status, and trust.**

each other more in happier societies, and such a predictive power is not enjoyed by income per capita (*GDP*).

## DISCUSSION

**Limitations.** We have analyzed a convenience sample of self-selected individuals who have used a Facebook application. Since social capital is confounded by level of posting activity on Facebook [7], critics might rightly say that happiness might be confounded by the use of the application. However, the application has had a large number of users, largely because it not only offered the *SWL* test but also other popular tests. Users were motivated primarily by the prospect of taking reliable tests and receiving feedbacks. That encouraged them to respond honestly. Still, the resulting sample is not representative of the general population. Users are young, and some ethnic groups might be underrepresented. Hence the countries we have been able to study are rich and have high Facebook's penetration rates. Yet, for these countries, mean *SWL* scores on Facebook produced a ranking that well represented the official ranking of self-reported well-being in the general population.

**Theoretical Implications.** This work touches upon two theoretical aspects.

*Inequality and Well-being.* Cross-country research has shown that the indicators we have studied here have little or no relation to levels of average incomes in a country, but are strongly related to income inequality [31]. We studied all these indicators anew, but now in relation to well-being. What our new evidence adds is coherence and specificity. We have been able to distinguish what relates to inequality from what relates to well-being (the two have a correlation of  $r = -0.54$ ). One would expect to find, as we do, that factors that correlate with well-being the most are those associated with social relations (e.g., trust, gender gap) while those that correlate with inequality (e.g., health

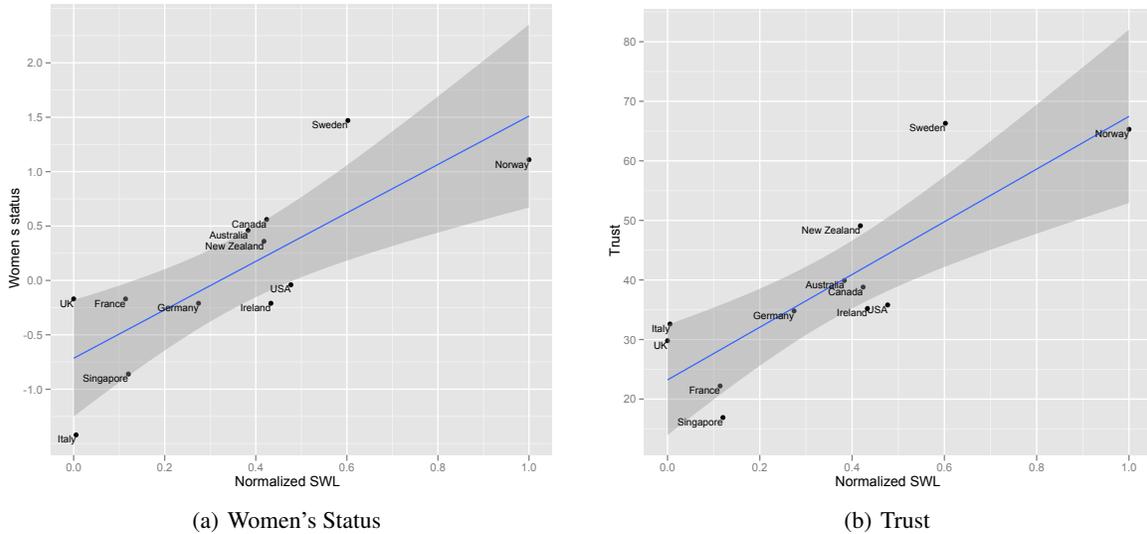


Figure 5. Women's status and trust are (strongly) related to happiness.

problems) are material consequences. More specifically, based on data on income inequality from the Human Development Indicators (HDI)<sup>4</sup>, we find that, compared to happiness, income inequality better explains factors related to food and illegal drug consumption, education, and sustainability. For example, the strongest association with spending on foreign aid is found for income inequality - more equal societies spend a higher proportion their income on overseas aid ( $r$  is as high as  $-0.82$ ). More generally, Table 3 reports the predictive power in terms of percentage  $R^2$  for different linear regression models whose predictors are: *SWL* only for model 1; *GDP* only for model 2; inequality only for model 3; *SWL* and *GDP* for model 4; and *SWL*, *GDP*, and inequality for model 5. From the table, we see that inequality explains high percentages of the variability for the indicators related to obesity, children well-being, and peace. By contrast, happiness better explains the indicators for functioning of democracy, women's status, and trust.

*Causal inference.* This has been an observational study in which casual inference has not been established (and it was not the aim of the study). However, there are three remarks to be made to suggest that causality does not necessarily go in the opposite direction, that is, in the direction of more social problems leading to unhappiness.

1. Many of the causal processes leading from unhappiness to the various health and social problems are already known. For example, the effects of well-being on trust have been demonstrated consistently across different cultures [17]. There is consistent evidence that happiness is not just an output but also an input,

<sup>4</sup>Income inequality is measured as the ratio of the total annual income received by the richest 20% of the population to the total annual income received by the poorest 20% of the population <http://hdr.undp.org/en/statistics/>

i.e., it can potentially increase our levels of creativity and productivity [22]. Over the years, the prominent American psychologist Ed Diener and colleagues have consistently shown that happiness is not just a by-product of success, but that many successes in life (e.g., work life, social relationships, health) are a by-product of happiness as well [18].

2. Some of the correlations are weak, suggesting that there are factors other than happiness (e.g., income inequality) that also explain the social problems related to food and illegal drug consumption, education, and sustainability. Instead, the correlations for the remaining indicators - those with democracy, women's status, and trust - are very strong and exhibit a dose-response form; as happiness increases so does trust or women's status.
3. There is a clear tendency for the three factors of democracy, women's status, and trust to move together - countries which do badly (or well) on one outcome to do badly (or well) on others. This implies that they share an underlying cause. If they were instead separate causes of unhappiness, that would not explain why they move together.

This is to say that, for some indicators, happiness should not be considered an output but an input. Robert Putnam has discussed how inequality relates to "social capital" (which is quantified as the sum of people's involvement in community life) [24]:

... the casual arrows are likely to run in both directions, with citizens in high social capital states likely to do more to reduce inequalities, and inequalities themselves likely to be socially divisive ...

In his book "Bowling Alone", he adds [23]:

... Community and equality are mutually reinforcing ... Social capital and economic equality moved in tandem through most of the twentieth century ...

**Practical Implications.** Based on our results, it seems that social-networking sites open up new ways of conducting social science research. We have shown how Facebook would allow researchers to track the emotional health of individuals in rich countries, which, given the limited contribution from economic growth, are those more in need of well-being policies. The ability to tracking well-being could also enable researchers to assess the effects of, for example, austerity measures. One could also extend data collection to developing countries by using means other than Facebook - for example, text messages. Using mobile phones to run social campaigns has not been uncommon in those countries, and FrontlineSMS is a case in point. The SWL test then lends itself to text messages as it consists of only five short questions with numerical answers. Another class of applications could come from the “quantified-self” movement, whose adepts quantify private aspects of their lives. Alexandra Carmichael, for example, tracks 40 things about herself daily, including mood, chronic pain levels, and sexual activity [27]. At times, these measurements are also shared on social-networking sites such as Facebook. Since research has shown that happiness is strongly linked to average country-by-country hypertension levels [1], one could collect blood pressure measurements using, for example, heart rate monitor watches and share them with a social media application at little cost and, to avoid privacy concerns, aggregate them for each country. More generally, the possibility of using social media for social science research supports the vision behind “computational social science”: being able to collect and analyze massive amounts of data could transform fields like economics, sociology, and political science.

## CONCLUSION

Further economic growth will not improve our well-being. We found that a wide range of social problems are associated with lack of well-being but are not associated with absolute levels of income as such. The evidence outlined here goes some way to establishing the point that numerous social problems - from problems with the functioning of democracy to gender gap - are more common in societies with lower levels of well-being. This simple but important point has been made upon Facebook data, suggesting that, under certain conditions, Facebook opens up new, alternative ways of conducting data-driven social science research - though whether Facebook will be used more to advertise the latest electronic gadget than to promote social change may be another question. Researchers might well promote one direction over the other depending on the effort they will put into cross-cultural studies of social media [8].

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