Happiness and Productivity

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24 March 2009

JEL Classification: D03, J24, C91

Keywords: Labor productivity; emotions; well-being; happiness; positive affect; experimental economics.

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Acknowledgements: For fine research assistance and valuable discussions, we are indebted to Malena Digiuni, Alex Dobson and Lucy Rippon. For helpful advice, we would like to record our deep gratitude to Alice Isen. Seminar audiences at PSE Paris and Zurich provided insightful suggestions. Thanks also go to Johannes Aberler, Eve Caroli, Emanuele Castano, Andrew Clark, Alain Cohn, Ernst Fehr, Justina Fischer, Bruno Frey, Dan Gilbert, Amanda Goodall, Greg Jones, Michel Marechal, Sharun Mukand, Aldo Rustichini, Daniel Schunk, Claudia Senik, and Tanya Singer. The first author thanks the University of Zurich for a visiting professorship. The ESRC and the Leverhulme Trust provided research support.

Abstract

Almost nothing is known by economists about how emotions affect labor productivity. To make persuasive progress, some way has to be found to assign people exogenously to different feelings. This paper designs a randomized trial. Some subjects have their happiness levels increased, while those in a control group do not. A rise in happiness leads to greater productivity in a paid piece-rate task. The effect is large; it can be replicated; it is not a reciprocity effect; it occurs equally among males and females; treated individuals change their output and not per-piece work quality. We discuss implications for economics.

Happiness and Productivity

1. Introduction

There is a large economics literature on individual and economy-wide productivity. There is also a fast-growing one on the measurement of mental well-being. Yet economists currently know little about the interplay between emotions and human productivity. Although people's happiness and effort decisions are likely to be intertwined, we lack evidence on whether, and how, they are causally connected.

This paper makes two contributions.

First, it attempts to alert economists to a literature in which happiness (or what psychologists refer to as positive affect) has been shown to be associated with higher human creativity and, in certain settings, greater performance. A body of empirical research by psychologists such as Alice Isen -- described in Ashby et al (1999) and elsewhere -- has existed for some years.[1] This avenue of work can be traced back to at least two early discoveries. First, positive affect improves memory recall (Isen et al 1978; Teasdale and Fogarty 1979); second, positive affect leads to greater altruistic helping of others (Isen and Simmonds 1978). Subsequently, the consequences of positive affect[2] for other human actions came to be studied.

The second and main objective of our paper is to implement an empirical test that has not been performed in the psychology literature. By doing so, we address a question that is of special interest to economists (and arguably to economic policy-makers): *Does happiness make people more productive in a paid task?*

The paper shows that it does. We demonstrate this experimentally in a piece-rate 'white-collar' setting[3] with otherwise well-understood properties.[4] Interestingly, the effect operates through a rise in sheer output rather than in the per-item quality of the laboratory subjects' work. Effort increases. Precision remains unaltered.

2. Background

The links between productivity and human well-being are of interest to many kinds of social scientists. Argyle (1989, 2001) points out that little is understood

[1] We list a number of them in the paper's references; they include a series of papers in the 1980s, Ashby et al (1999), Erez and Isen (2002), and the recent work of Hermalin and Isen (2008). A survey is available in Isen (1999). Our study also has links to ideas in the broaden-and-build approach of Frederickson and Joiner (2002) and to the arguments of Lyubomirsky et al (2005).

[2] Our work connects to Richard Freeman's (1978) early call for economists to treat job satisfaction as an influential variable in labor economics.

[3] Such as Niederle and Vesterlund (2007).

[4] The analysis draws on a kind of mood induction procedure that is uncommon in the economics literature but is familiar to researchers in social psychology. One exception is Kirchsteiger, Rigotti, and Rustichini (2006) who find a substantial impact in the context of gift-exchange.

about how life satisfaction affects productivity, but that there is (some) evidence that job satisfaction exhibits modestly positive correlations with measures of worker productivity. Work by Wright and Staw (1999) examines the connections between worker affect and supervisors' ratings of workers. Depending on the affect measure, the authors find mixed results. Amabile et al (2005) uncovers evidence that happiness provokes greater creativity. In contrast to our paper's later argument, Sanna et al (1996) suggests that those individuals in a negative mood put forth a high level of effort. Baker et al (1997), Boehm and Lyubomirsky (2008), Paterson et al (2004), Steele and Aronson (1995) and Tsai et al (2007) detect influences of emotion and affect upon performance. These results are for unpaid activities, namely, where the laboratory subjects' marginal wage rate is zero.

A small analytical literature written by economists is relevant to our later empirical findings. Although not directly about happiness, it examines the interconnections between psychological forces (in particular, biased perception) and human performance.

The paper by Benabou and Tirole (2002) focuses on the interactions between self-deception, malleability of memory, and ability and effort. The authors consider the possibility that self-confidence enhances the motivation to act, so their framework is consistent with the idea that there can be a connection between mood and productivity. They develop an economic model of why people value their self-image, and they use this specifically to justify seemingly irrational practices such as handicapping self-performance or the practising of self-deception through selective memory loss. Compte and Postlewaite (2004) extends this line of work, by seeking to identify circumstances in which biased perceptions might increase welfare. The authors model perceptions as an accumulation of past experiences given gradual adjustment. Benabou and Tirole (2003) provides a formal reconciliation of the importance of intrinsic motivations with extrinsic (incentivised) motivations. Such writings reflect an increasing interest among economists in how to reconcile external incentives with intrinsic forces such as self-motivation.

Our later results also have implications for standard microeconomics as described in sources such as Laffont and Tirole (1993). This body of work effectively assumes -- in contrast to later evidence in the paper -- that choices can be viewed as independent of emotions.[5]

Gneezy and Rustichini (2000) examine the relationship between monetary compensation and performance. They provide contrasting kinds of evidence. They show that increasing the size of monetary compensation raises performance, but they also find that offering no monetary compensation can be better motivation than offering some. They discuss how to rationalize this finding, and offer several possible explanations. One is based on the notions of intrinsic and extrinsic motivation developed within psychology. Put simply, subjects may be intrinsically motivated to do well, but this is displaced when they are offered a form of extrinsic motivation (monetary compensation). In these terms, our paper tries to examine the impact of mood on intrinsic motivation (by holding constant the level of monetary compensation) and so builds upon Gneezy and Rustichini's contribution.

We shall not attempt in the paper to distinguish linguistically in a sharp way between happiness and mood. For simplicity, we take the distinction, in a short run experiment like the one to be described, to be predominantly semantic. Nor do we explore the possibility that other stimuli such as music, alcohol or sheer relaxation time -- all mentioned by readers of early drafts -- could have equivalent effects. Nor can we assess exactly how long-lasting are the effects of emotion upon labor productivity. Our instinct is that each of these is a potentially important topic for future research.

3. A model of work and distraction

This section describes a theoretical framework. Its aim is partly taxonomic. The main comparative static result stems from a form of internal resource-allocation by a worker. A later section discusses the theoretical model in the light of the answers that (a subset of) laboratory subjects gave to a questionnaire presented to them at the end of the experiment. The modeling structure we sketch is potentially complementary to Ashby et al's (1999) neurobiological one, where the emphasis is on

[5] A review paper in psychology is Diener et al (1999). A considerable literature in economics has studied happiness and wellbeing as a dependent variable – including Blanchflower and Oswald (2004), Clark et al (2008), Di Tella et al (2001), Easterlin (2003), Frey and Stutzer (2002, 2006), Kahneman and Sugden (2005), Luttmer (2005), Oswald (1997), Van Praag and Ferrer-I-Carbonell (2004), and Winkelmann and Winkelmann (1998). For related work on emotions, see Frank (1988), Elster (1998), and Loewenstein (2000).

a route from positive affect to increased dopamine, but ours is framed in the choice-theoretic style of neoclassical economics.

Think of individuals as having a finite amount of energy. Within any period of time, they must choose how to distribute that across different activities. In one version of the later model, a happiness shock can be seen as raising the psychological resources available to a worker. At the margin, the shock frees an overall energy constraint. That, in turn, allows an individual to devote more effort to solving problems for pay, and to act as though switching away from other distractions.

Let the worker's (randomly distributed) ability be *z*. This has a density function *f(z)*. Denote *p* as the piece-rate level of pay.[6]

Denote *u* and *v* as two different sources of utility to the individual. Let *e* be the energy the worker devotes to solving tasks at work. Let *w* be the energy the worker devotes to other things -- to 'distractions' from work. Let *R* be the worker's psychological resources. Hence *(e + w)* must be less than or equal to *R*.

We assume that *u*, the utility from work, depends on both the worker's earnings and effort put into solving work problems. Then *v* is the utility from attending broadly to the remaining aspects in life. For concreteness, we shall sometimes think of this second activity as a form of 'worrying'. But it can be viewed as a generalized concern for issues in the worker's life that need his or her cognitive attention. In a paid-task setting, it might be realistic to think of a person as alternating, during the working day, between concentrating on the work task and being distracted by the rest of his or her life. There is a psychic return from the energy devoted to distraction and worry -- just as there is a return from concentrating on the paid task.[7]

Consider an initial happiness shock, *h*. For the sake of clarity, assume separability between the two kinds of utility going to the individual. People then solve the problem: choose paid-task energy *e* to

Maximize $\int u(p,e,h,z)\,f(z)dz + v(w,h)$ subject to $R \geq e + w$

where the first-order condition for a maximum in this problem is simply

[6] For simplicity, we assume that individuals know *p* exactly. In many of our sessions *p* was not made precise; instead we specified the range of payments available and stated that payment would be increasing in performance. However, comparing these sessions with those in which the precise payment rule was specified indicates that whether the precise payment rule is specified or not is insignificant for our results. For more on this, see part 2 of the appendix for an analysis of the impact of the payment rule and part 3 of the appendix for the full instructions.

[7] Indeed many respondents to the subject questionnaire used phrases like "distracting" and "relaxing" to describe the effect of the mood-inducement device used during the experiments, though we found that they were not necessarily capable of consciously and correctly estimating the direction of the effect on their performance.

$$Eu_e - v_w = 0. \qquad (1)$$

The comparative-static result of particular interest here is the response of productivity, given by work effort *e*, to a rise in the initial happiness shock, *h*. Formally, it is determined in a standard way. The sign of *de*/dh* takes the sign of the cross partial of the maximand, so that:

Sign *de*/dh* takes the sign of $Eu_{eh} + v_{wh}$. (2)

Without more restrictions, this sign could be positive or negative. A happiness shock could increase or decrease the amount of effort put into the work task.

To get some insight into the likely economic outcome, consider simple forms of these functions. Assume that workers know their own productivity. Let *R* be normalized to unity. Set *z* to unity. Assume that the *u* and *v* functions are concave and differentiable. This is not strictly necessary, but it follows the economist's modeling tradition, and leads to natural forms of interior solutions. The analysis is easily generalized.

How then might an exogenous happiness perturbation, *h*, enter a person's objective function? In stylized form, consider three alternative maximands:

Model I	*u(.) + v(.) + h*	*Additive shift*
Model II	*u(h, .) + v(h, .)*	*Concavity*
Model III	*hu(.) + (1 – h)v(.)*	*Convex combination*

Additive separability

The additive model is -- we conjecture -- what most economists would write down when asked to think about exogenous emotions and choice. They would view a happiness shock as a vertical shift upwards in the utility function.

Assuming additively separable functions, and that the worker gets the *h* happiness shock whether or not he or she subsequently works or instead worries about other things, the worker solves:

Maximize $u(pe) + v(1-e) + h$ (3)

and at an interior maximum

$$u'(pe)p - v'(1-e) = 0. \qquad (4)$$

This is a mathematically elementary but economically useful benchmark case: here the optimal work effort *e** is independent of the happiness shock, *h*. Thus as the parameter *h* rises or falls, the marginal return to effort is unaffected. Happiness therefore does nothing to effort. It can be seen as orthogonal to choice. In passing, a variant on this is the simple multiplicative form:

Maximize $(1+h)[u(pe)+v(1-e)]$ (5)

where shocks to *h* again have no effect on optimal work-energy *e**.

<u>A concavity case</u>

Another, and arguably more plausible, form of utility function has a happiness shock operating within a concave structure. Imagine the worker solves

Maximize $u(pe+h)+v(1-e+h)$ (6)

which is the assumption that *h* is a shift variable inside the utility function itself, rather than an additive part of that function.

Now the first-order condition is

$u'(pe+h)p-v'(1-e+h)=0$. (7)

In this case, the optimal level of energy devoted to solving work problems, *e**, does depend on the level of the happiness shock, *h*:

The sign of *de*/dh* takes the sign of $u''(pe+h)p-v''(1-e+h)$.

Its first element is thus negative and its second is positive. By the first-order condition, we can replace the piece rate wage term *p* by the ratio of the marginal utilities from working and worrying.

Hence, after substitution, the sign of the comparative static response of *work effort, e, with respect to the size of the happiness shock, h, is greater than or equal to zero* as

$$\frac{u''(.)}{u'(.)}-\frac{v''(.)}{v'(.)}\geq 0. \quad (8)$$

These terms can be viewed as unconventional versions of the degrees of absolute risk aversion in two domains -- the utility from work and the utility from worrying. If the marginal utility of worry declines quickly enough as energy is transferred from working to worrying, then a positive happiness shock will successfully raise the worker's chosen productivity, *e**. Put intuitively, as the individual become happier, that allows him or her to divert attention away from other issues in life.

A convex-combination case

A final hypothesis is that happiness operates asymmetrically, namely, that it acts to tilt people's preferences away from distractions. For instance, assume that the worker solves

Maximize $hu(pe)+(1-h)v(1-e)$ (9)

which is the assumption that *h* acts as part of a convex combination outside the utility function itself -- rather than within it or as an additive part of that function.

In such a circumstance, the first-order condition is

$hu'(pe)p-(1-h)v'(1-e)=0$. (10)

It can be seen that the sign of *de*/dh* under such a setup takes the sign of the expression $u'(pe)p+v'(1-e)$ which is automatically positive because it is the weighted sum of two marginal utilities. A positive happiness shock therefore lifts work effort *e**.

These later approaches, in which effort is not independent of *h*, potentially offer economists something else. They suggest a way to think about stress in the workplace. Work-life strain could be conceived of as the (rational) need to devote energy and attention away from the job (where in the latter case our framework has the same characteristic as Banerjee and Mullainathan 2008). Happier workers need to do so less, and thus have higher productivity.

4. Experimental design

We now turn to the structure of the experiment. We start with a motivation for the choices made within the design, and then provide a description of the tasks and a time-line for the trial. The experimental instructions, the GMAT MATH-style test, and the questionnaires are set out in an appendix.

The experimental design was built around the desire to understand the productivity of workers engaged in a task for pay. Our focus is the consequences, for their output, of different starting levels of happiness.

We employ a task previously used in Niederle and Vesterlund (2007), which entails asking subjects to add sequences of five 2-digit numbers under timed conditions. The task is in itself simple but is taxing under pressure. It might be thought of as representing in a highly stylized way an iconic white-collar job: both intellectual ability and effort are rewarded.

Since we are trying to evaluate the relationship between happiness and productivity, we wish ideally to disentangle the effort component and ability component. To this end, we also allowed for two control variables that we hoped would capture underlying exogenous but heterogeneous ability as opposed to effort -- although we were also open to the possibility that changes in underlying happiness might induce shifts in ability or change the nature of the interaction between ability and effort to alter overall productivity. Our control variables came from (i) requiring our subjects to do a brief GMAT MATH-style test (5 multiple choice questions) along similar lines to that of Gneezy and Rustichini (2000), and (ii) obtaining information in a final questionnaire to allow us to construct a measure of subjects' prior exposure to mathematics. The aim was to allow us to control for heterogeneous ability.[8]

The key concern was to examine the consequences that happiness has for productivity (be it through effort or ability). We therefore needed some means of inducing an exogenous rise in happiness. The psychology literature offers evidence that movie clips (through their joint operation as a form of audio and visual stimulus) are a means of doing so. They exogenously alter people's feelings. By way of example, Westermann et al (1996) provides a meta-analysis of the methods available.

We used a 10-minute clip based on composite sketches taken from various comedy routines enacted by a well-known British comedian. In order to ensure that the clip and subjects were well matched, we restricted our laboratory pool to subjects of an English background who had likely been exposed to similar humor before. As explained later, whether subjects enjoyed the clip turned out to be important to the effects on productivity.

While our key treatment involved the use of the clip as compared with a control treatment identical but for the lack of a clip, we also wanted to address the possibility that the time spent watching the movie clip might be an important factor. Hence we also ran a second control treatment in which we used a "placebo" film clip designed to be neutral with regard to mood, but to take up the same amount of time as the comedy clip. However, the data revealed that this placebo clip was not significantly different from showing no clip whatsoever. These results are reported in

[8] We deliberately kept the number of GMAT MATH-style questions low. This was to try to remove any effort component from the task so as to keep it a cleaner measure of raw ability: 5 questions in 5 minutes is a relatively generous amount of time for an IQ-based test, and casual observation indicated that subjects did not have any difficulty giving some answers to the GMAT MATH-style questions, often well within the 5-minute deadline.

part 2 of the appendix.

In summary, the data collected included the number of successful and unsuccessful numerical additions, performance in a brief GMAT MATH-style test, and (for a subset of laboratory subjects) responses to a questionnaire that included questions relating to happiness, personal characteristics and intellectual ability.

5. Design in detail

We randomly assigned people into two groups:

Treatment 0: the control group who were not exposed to a comedy film clip.

Treatment 1: the treated group who were exposed to the comedy clip.

The control-group individuals were never present in the same room with the treated subjects (hence they never overheard laughter, or had any other interaction). The experiment was carried out on six days, with deliberate alteration of the morning and afternoon slots, so as to avoid underlying time-of-day effects, as follows.

Our main experiment took place over 4 days and 8 sessions; we then added 4 more sessions to check for the robustness of our central result to both the introduction of an explicit payment and a placebo film (shown to the otherwise untreated group).

Accordingly, the experiment consists of

- Day 1: session 1 (treatment 0 only), session 2 (treatment 1 only).
- Day 2: session 1 (treatment 0 only), session 2 (treatment 1 only).
- Day 3: session 1 (treatment 1 only), session 2 (treatment 0 only).
- Day 4: session 1 (treatment 1 only), session 2 (treatment 0 only).

plus

- Day 5: session 1 (treatment 1 and explicit payment), session 2 (treatment 0 and placebo clip)
- Day 6: session 1 (treatment 0 and explicit payment), session 2 (treatment 1 and explicit payment)

Subjects were allowed to take part on only one day and in a single session.

On arrival in the lab, individuals were randomly allocated an ID, and made aware that the tasks at hand would be completed anonymously. They were asked to refrain from communication with each other. Those in treatment 1 (the Happiness Treatment subjects) were asked to watch a 10 minute comedy clip designed to raise happiness or 'positive affect'.[9] Those in the control group came separately from the other group, and were neither shown a clip nor asked to wait for 10 minutes. In a different setting, Isen et al (1987) found that a control clip without positive affect gives the same general outcomes as no clip, which we later confirmed in our own "placebo" treatment (day 5, session 2).

For days 1-4, the subjects in both the movie-clip group (treatment 1) and the not-exposed-to-the-clip control group (treatment 0) were given identical basic instructions about the experiment. These included a clear explanation that their final payment would be a combination of a show-up fee (£5) and a performance-related fee to be determined by the number of correct answers in the tasks ahead. At the recruitment stage it was stated that subjects would make "… a guaranteed £5, and from £0 to a feasible maximum of around £20 based purely on performance". Technically, subjects received £0.25 per correct answer on the arithmetic task and £0.50 on each correct GMAT MATH answer, and this was rounded up to avoid the need to give them large numbers of coins as payment. We preferred in our main trials not to specify exact details of payments, although we communicated clearly to the subjects that the payment was performance-related. Our aim was to mimic real-life situations -- where workers usually do not know the precise return from each productive action they take.

We then ran sessions in days 5 and 6 in which subjects were told the explicit rate of pay both for the numerical additions (£0.25 per correct answer) and GMAT MATH-style questions (£0.50 per correct answer). This was as a robustness check and to investigate the impact of analyzing explicit payment rates (a traditional piece rate setting) as opposed to a non-explicit rate (a performance-rated bonus). Later findings reveal that the role of happiness was not significantly different in days 5-6 as opposed to days 1-4, and so we focus on the results from days 1-4.

One reason to pay subjects more for every correct answer was to emphasize that they would be benefit from higher performance. We wished to avoid the idea that they might be paying back effort -- as in a kind of reciprocity effect -- to the investigators for their show-up fee.

The subjects' first task was to answer correctly as many different additions of five 2-digit numbers as possible. The time allowed for this, which was explained to

[9] The questionnaire results indicate that the clip was generally found to be entertaining and had a direct impact on reported happiness levels. More on this is in the results section.

them beforehand, was 10 minutes. Each subject had a randomly designed sequence of these arithmetical questions. Numerical additions were undertaken directly through a protected Excel spreadsheet, with a typical example as in Legend 1. The spreadsheet necessarily contained more such rows that any subject could hope to add in the ten minutes allowed. The subjects were not allowed to use calculators, and it was explained that any attempt to use a calculator or any outside assistance was deemed to be a disqualification offence, resulting in only the show-up fee being paid. This did not prove to be a problem across the 4 experimental days. The numerical additions were designed to be reasonably simple, if repetitive, and earlier literature has deemed this a good measure of intellectual effort (Niederle and Vesterlund, 2007).

31	56	14	44	87	

Legend 1: Adding 2-digit Numbers

The second task for subjects was to complete a simple 5-question GMAT MATH-style test. These questions were provided on paper, and the answers were inputted into a prepared protected Excel spreadsheet. The exact questions are given in an appendix. This test was designed as a brief check on ability, as used before in the research literature (Gneezy and Rustichini, 2000).

The final task, which was not subject to a performance-related payment (and subjects were made aware of this), was to complete a questionnaire. A copy of this is provided in an appendix. The questionnaire inquired into both the happiness level of subjects (before and after the clip for treatment 1), and their level of mathematical expertise. The wording was designed to be straightforward to answer; anonymity was once again stressed before it was undertaken; the scale used was a conventional 7-point metric, following the well-being literature.

Moreover, in day 5 and day 6, we added extra questions (as detailed in the appendix). These were designed to inquire into subjects' motivations and their own perceptions of what was happening to them. The purpose was to try to shed light on the psychological mechanism that made our treated subjects work harder.

To summarize the timeline:[10]

[10] The full instructions provided in the appendix provide a description of the timing.

1. Subjects enter and are given basic instructions on experimental etiquette.

2. Subjects in treatment 1 are exposed to a comedy clip for 10 minutes, otherwise not.

3. Subjects are given additional instructions, including a statement that their final payment relates to the number of correct answers, and instructed against the use of calculators or similar.

4. Subjects move to their networked consoles and undertake the numerical additions for 10 minutes.

5. Results are saved and a new task is initiated, with subjects undertaking the GMAT MATH-style test for 5 minutes.

6. Results are again saved, and subjects then complete the final questionnaire.

7. After the questionnaire has been completed, subjects receive payment as calculated by the central computer.

6. Principal results

A group of 276 subjects drawn from the University of Warwick participated in the experiment. Of these, 182 took part in the main experiment, while the others participated in the sessions of day 5 and 6. Each took part in only one session. A detailed breakdown of the numbers per day and per session is contained in Table 1.

For expositional clarity, we now describe the results of the main sessions. We later report the results for the extra sessions with the placebo film and explicit payment scheme.

The subject pool here was made up of 110 males and 72 females. Table 2 summarizes the means and standard deviations of the main variables. The first variable, the key one in our analysis, is the number of correct additions in the allotted ten minutes. ‘Happiness before’ is the self-reported level of happiness (for the treated group before the clip) on a seven point scale. The variable ‘happiness after’ is the level of happiness after the clip for the treated group; GMAT MATH is the number of correct problem solved on that; high-school-grades is an index calculated from the questionnaire. Enjoyment-of-clip is a measure in a range between 1 and 7 of how much they said they liked the movie clip.

According to the data, the clip is successful in increasing the happiness levels of subjects. As shown in Figure 1, they report an average rise of almost one point (0.98) on the scale of 1 to 7. Moreover, comparing the ex-post happiness of the treated subjects with that of the non-treated subjects, we observe that the average of the former is higher by 0.85 points. Using a two-sided t-test, this difference is statistically significant (p <0.01). Finally, it is useful to notice that the reported level of happiness before the clip for the treated group is not statistically significantly different (the difference is just 0.13) from the happiness of the untreated group (p = 0.20 on the difference).

Figure 2 displays the mean levels of productivity. The treated group's mean performance is higher by 1.71 additions than the average performance of the untreated group. This productivity difference is considerable; it is approximately ten percent. It is also statistically significantly different from zero (p=0.04).

A sub-group was noticeable in the data. Interestingly, and encouragingly, the performance of those 16 subjects in the treated group who did not report an increase in happiness is statistically non-different from the performance of the untreated group (p=0.67). Therefore, the increase in the performance seems to be linked to the increase in happiness rather than merely to the fact of watching a movie clip. The clip did not hamper the performance of subjects who did not declare themselves happier.[11] For them, the effect is zero. We return to this below.

In Figure 3 we show the performances of male and female subjects. Both groups feature a similar increase in their arithmetical productivity (1.90 additions for male, 1.78 for female). These effects do not operate perfectly symmetrically. From the cumulative distributions on the number of correct answers for the treated and untreated groups, shown in Figure 4, we see that the treatment increases the performances of low and medium performers, while the high performers are apparently less affected.

So far, these findings are for elementary t-tests. We also performed OLS-based regressions to analyze the determinants of performance. Table 3 presents equations for the number of correct additions. The variable called Change-in-Happiness is the difference in reported happiness before and after the clip; GMAT MATH is a test score. High school grades measure school performance. Day 2, Day

[11] The 17 subjects who did not declare an increase in happiness enjoyed the clip. In a range of values between 1 and 7, the average is 5.41, with a minimum of 5 and a maximum of 7.

3 and Day 4 are day-of-the-week dummies.

Consistent with the result seen in the previous session, the subjects' performances are higher in the treated sessions. As we can see in Table 3's regression (1), in the first column, this result holds when we control for subjects' characteristics and periods. The coefficient of 0.118 implies that the happiness treatment increases people's productivity by approximately 12%. In regression (2) of Table 3, the performances are increasing in the rise in elicited happiness (for the case of untreated subjects, by definition, Change-in-Happiness=0). This result is still true when we restrict the analysis to the treated subjects alone, as in regression (3). The size of the effect is only slightly smaller (than in column 2 of Table 3) at approximately eight and a half percentage points.

Because of the known skewness in human-performance data, it is most natural here to use a logged variable. Nevertheless, as a rough check, Table 4 re-runs the first two regressions of Table 3 with a dependent variable defined on absolute values rather than log values. The variable 'Treatment' remains large and positive. It is statistically significant when, as in regression 2 of Table 4, we exclude the outliers (here we drop the two extreme laboratory subjects, with respectively 2 and 43 correct additions). The coefficient on the variable Change-in-Happiness is statistically significantly different from zero irrespective of whether or not in Table 4 we keep in the two outliers: see regressions 3 and 4.

Might the pattern in the data be in part a kind of reciprocity effect? Are these laboratory subjects 'repaying', or somehow trying to please, the investigators? Such difficulties are not uncommon in economics experiments. However, that argument does not apply here. In our experiment, people get paid more for every addition they solve. That money goes to them, so that, if anything, extra productivity hurts rather than aids the investigators. There might be some kind of implicit reciprocity effect -- an implicit gift from the subjects in exchange for their show-up fee -- hidden within the constant term. But that does not interfere with the purpose of this experiment because it is conceptually distinct from the marginal change in paid productivity that we observe.

Another concern might be that the subjects convince themselves that the fact of watching a clip per se might enhance performance. In section 7 we discuss this and find that it is unlikely to be true. We show that individuals who are treated with a placebo clip do not perform significantly differently from individuals who are untreated (and, if anything, they do slightly worse on the additions task).

A related objection might be that our laboratory subjects for some reason believe that a comedy clip might enhance their performance and act as though trying to prove this conviction. To address this, we added direct questions to the questionnaires in days 5 and 6, asking subjects: “Did you try your best when asked to add numbers?”; “If so, why? If not, why not?”; “Did you feel that first observing the video clip made you better or worse at adding up numbers?”; and “Can you say why you believe that?” Among the treated subjects, out of 48 answers only 31% thought it had a good effect, for 23% this effect was bad, while 42% felt it was irrelevant. The number of subjects who declared that the clip had beneficial consequences was not statistically larger than the number of subjects who felt the effect likely to be bad (p=0.22). Furthermore, among the 25 subjects who were shown a placebo film – discussed later – the answers were similar (bad 44%, good 24%, indifferent 32%). The difference between subjects who thought that the placebo film had a positive influence is not statistically different from the number of subjects for which the real treatment had a positive effect (p=0.26). All this appears to point towards subjects not being able to assess the impact of the clip, and not being entirely sure whether we as experimenters were using the clip to aid or hinder them. As a side-effect, this may also lessen the concern that subjects were acting to please the experimenters by increasing performance, since generically the subjects could not forecast well.

It seems, therefore, that positive emotion invigorates human beings. Yet the mechanism here is unclear. Does happiness have its effect on labor productivity through greater numbers answered or through greater accuracy of the average answer? This distinction is of interest. It might even be viewed as one between industry and talent -- between the consequences of happiness for pure effort compared to effective skill.

To inquire into this, we estimate a different kind of equation. Table 5 takes <u>attempted additions</u> (in log terms) as the dependent variable. The results are similar to the ones in Table 3, where we considered the number of correct additions. Attempted additions rise by slightly more than 9%. Then, in Table 6, we run exactly the same regression as in Table 5 but with a different dependent variable. This is an estimated equation for ‘precision’, namely, the <u>ratio of correct-answers to attempted-answers</u>. Interestingly, in Table 6 neither the dummy treatment nor Change-in-Happiness is statistically significantly different from zero. This means that the treatment acts as an upward intercept shifter in the attempts equation; the treatment itself does not provide extra precision. It is perhaps also worth noting that subjects' precision levels are influenced by their underlying mathematical skill, as measured by the mini GMAT MATH score, and to a lesser extent by scholastic grades.

7. Empirical checks

We performed a variety of tests of robustness. The detailed results from these, with tables, are laid out in the appendix.

First, we examined sub-samples of data. Importantly, the positive effect on productivity was visible in a remarkably robust way in the data. This can be seen in the first part of the appendix. For example, in the raw data of Table A2, the productivity boost from the happiness treatment is observable in seven of the eight sub-trials. See the 4^{th} and 5^{th} columns of Table A2. The single exception is for males in Session 2, and that result is driven by one outlier -- the individual in the sample who scored an extraordinary 47 correct answers.

Tables A3 and A4 give regression results on further experimental breakdowns. The continued robustness of the main finding is evident.

Second, an extra trial was done in which a 'placebo' film -- a moderately interesting but not intrinsically happy clip -- was shown to a control group. This was to ensure that our productivity findings were not an outcome that any film might be produce. The film clip was "Computer Graphic" on James Gross's resources site: http://www-psych.stanford.edu/~psyphy/movs/computer_graphic.mov. This movie clip depicts patterns of colored sticks. These appear and disappear randomly on screen. The film is considered "neutral" by social psychologists. By setting the process to repeat, it was possible to play this clip for the appropriate length of time. Importantly, the productivity of individuals was not increased by showing them this placebo film. In Table A5, the number of correct additions declined marginally (not in a statistically significant way) when compared to the control setting used earlier in our paper, namely, where individuals straight away begin work on the additions tasks.

Third, a trial was done in which individuals were told an explicit monetary amount -- £0.25 -- for each correct answer. The purpose here was to check that having a specified payment did not alter the tenor of the findings. Productivity rose, although not in a statistically significant sense: see Table A5. More importantly, when this new scheme is added to the treatment, the variable is non significant, which suggests that the impact of happiness on productivity will not change if the payment is specified (in the second part of the appendix we give a more detailed description of the findings). These consistency tests are encouraging.

Much remains, nevertheless, to be understood. One puzzle generated by the data is about the nature of the transmission channel from human happiness to people's labor productivity. The paper's earlier theoretical framework describes a set of cases in which, as a structural or mathematical matter, the correct empirical prediction emerges. However, further experiments will have to be designed to try to probe the precise transmission mechanism.

In continuing work, we are collecting interview evidence from subjects. Such qualitative research may be able to throw up further insights.

Another consideration which may be relevant -- we thank Greg Jones for this suggestion -- is that happiness could act to increase cognitive flexibility. In some recent work, this has been proposed in a narrow context, of the perception of local versus global aspects of a visual scene (Baumann and Kuhl, 2005; Tan, Jones and Watson, in press). The argument is fairly simple. If someone is focusing on local aspects, then positive affect improves processing of global aspects; and if focusing on global aspects, then it encourages local processing. Jones and colleagues have called this "encouraging the perceptual underdog", and it is distinct from previous suggestions about, say, positive affect simply promoting global processing. It seems plausible to hypothesize that happiness could have a similar effect on a broader canvas, where labor productivity benefits from the individual worker being encouraged to try out hitherto neglected strategies.

8. Subjects' self-perceptions

Towards the end of our experimental trials, it became clear to us that the main result was occurring again and again. We therefore decided to attempt to probe in a qualitative way into what might be happening. In the light of 73 questionnaires completed by the subjects on days 5 and 6, we can ask which of the ideas discussed in section 3 are consistent with the subjects' own perceptions. In general, no subject declared that the treatment induced greater focus, while 10 percent of the treated subjects found the comedy clip distracting (this is significantly different from 0, with p=0.01). Taken at face value this seems to contradict model III which presumes a convex combination between the components of utility *v* and *w* and implies a higher level of concentration -- though only if subjects' own perceptions are correct.

Moreover, it seems that subjects disagree on the effect of the treatment on performance: out of 48 answers, for 31% the effect was positive, for 23% the effect was negative, while 42% felt it to be irrelevant. This seems to reflect the ambiguity of the effect of happiness on productivity implicit in model II. As shown in section 3, this effect is positive only if condition (8) is satisfied, which might be the cause of the variation in subject responses, though again a lack of self-perception about the ultimate effect of the clip is also equally plausible. While 88% of subjects who think that the effect is positive find the clip relaxing, 45% of subjects who think that the effect is negative find it distracting, and 12% still use the word "relaxing" albeit this time to describe a negative impact. If we interpret a pronouncement of "relaxing" by subjects for which the effect was positive as an indication of some relief from outside worries, and the pronouncement of "distracting" by subjects for which the effect was negative as an indication of an inability to focus on the task in hand, and perhaps an increased preoccupation with outside worries, this answer might be again consistent with model II. Once more we need to add a note of caution, as the ambiguity in subjects' responses might just as well be indicative of a general inability to correctly perceive the true impact of the clip on their own performance. This is especially plausible as no subject was allowed to take part in more than one session, and so there was no frame of reference for the subjects to consider.

To again consider how good the subjects were at correctly identifying the direction of the effect on their performance, we can try another approach. The 15 subjects who declared that the treatment had a positive effect made on average 21.33 correct additions, against the 18.54 of the remaining 33 subjects. This difference is insignificant (p=0.15), but the sample here is small. If we consider only subjects who felt relaxed, *and* thought the effect of the clip was positive, the p value is 0.10.

9. Conclusions

This paper finds that emotions have powerful economic effects. It suggests and implements a randomized trial. Some laboratory subjects have their happiness (or 'positive affect') levels increased. Others, in a control group, do not. Strikingly, a rise in happiness leads to greater productivity in a paid piece-rate task. The effect is large, can be replicated, is not a reciprocity response, and is found equally in male and female subsamples. It appears from the data that the effect operates though a rise in output rather than in the quality of the laboratory subjects' work. In this white-collar task, workers' effort levels go up while precision is unaltered.

Various implications emerge. First, it appears that economists need to pay attention to the influence of emotion. In so far as emotional forces currently play any role in empirical economics, they have been viewed, as in the literature on the economics of well-being, as a form of dependent variable. Second, wider bridges will have to be built between applied psychology and applied economics. Third, if happiness in a workplace carries with it a return in enhanced productivity, the paper's findings have consequences for firms' promotion policies[12] and how they structure their internal labor markets. Fourth, if happiness boosts human productivity, this raises the possibility of self-reinforcing spirals -- ones that might even operate at a macroeconomic level. Happiness might lead to greater productivity in an economy, and that might in turn trigger greater well-being. If happiness-productivity-happiness spirals could be shown to exist, they would be a fundamental propagation mechanism linking short-run shocks into the longer run, and represent an important avenue for future research.

[12] Over and above the neoclassical pay-effort mechanisms discussed in sources such as Oswald (1984).

Figure 1: Reported happiness

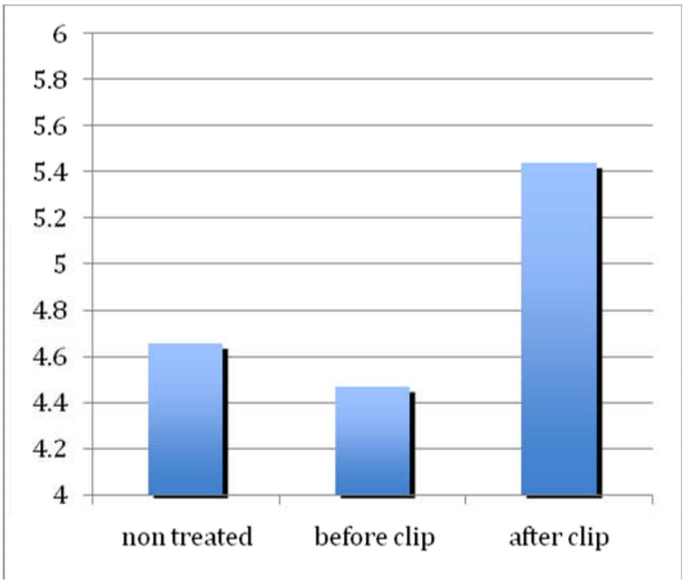

Figure 2: Number of correct additions

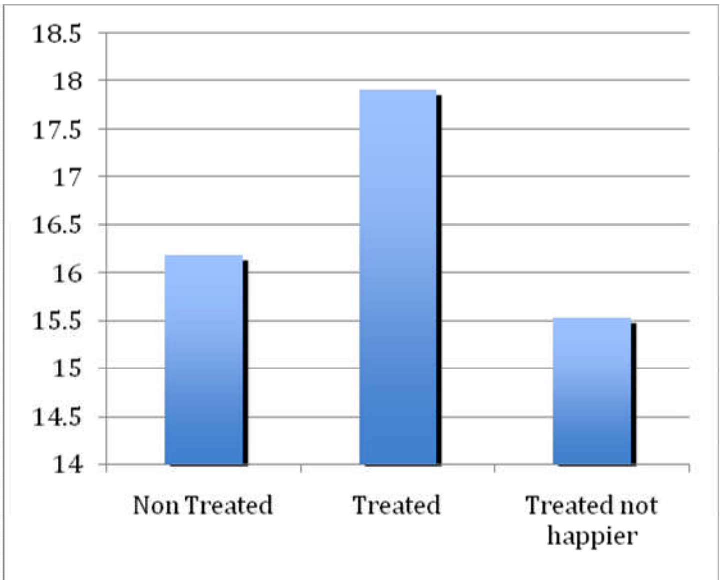

Figure 3: Performance difference between males and females

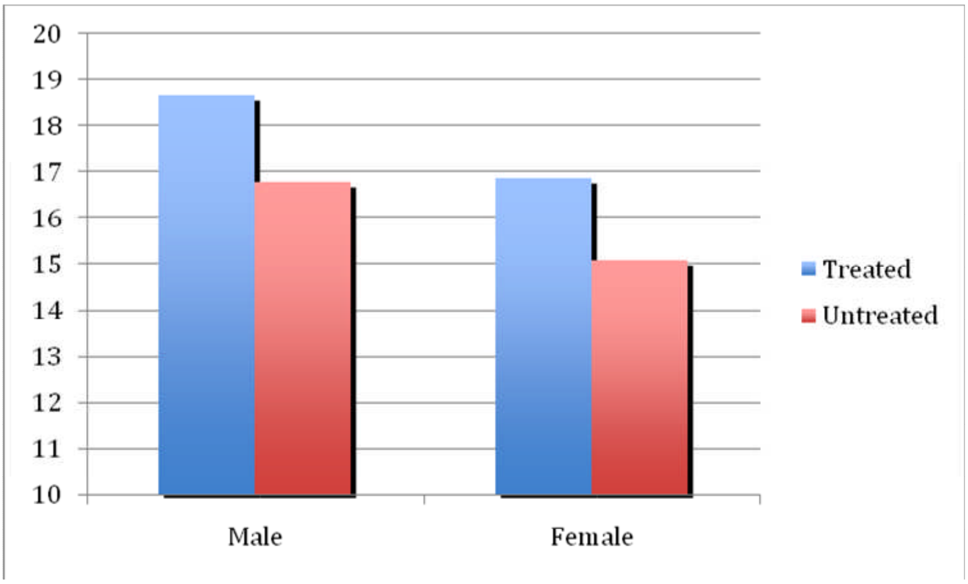

Figure 4: CDF of subjects' performances

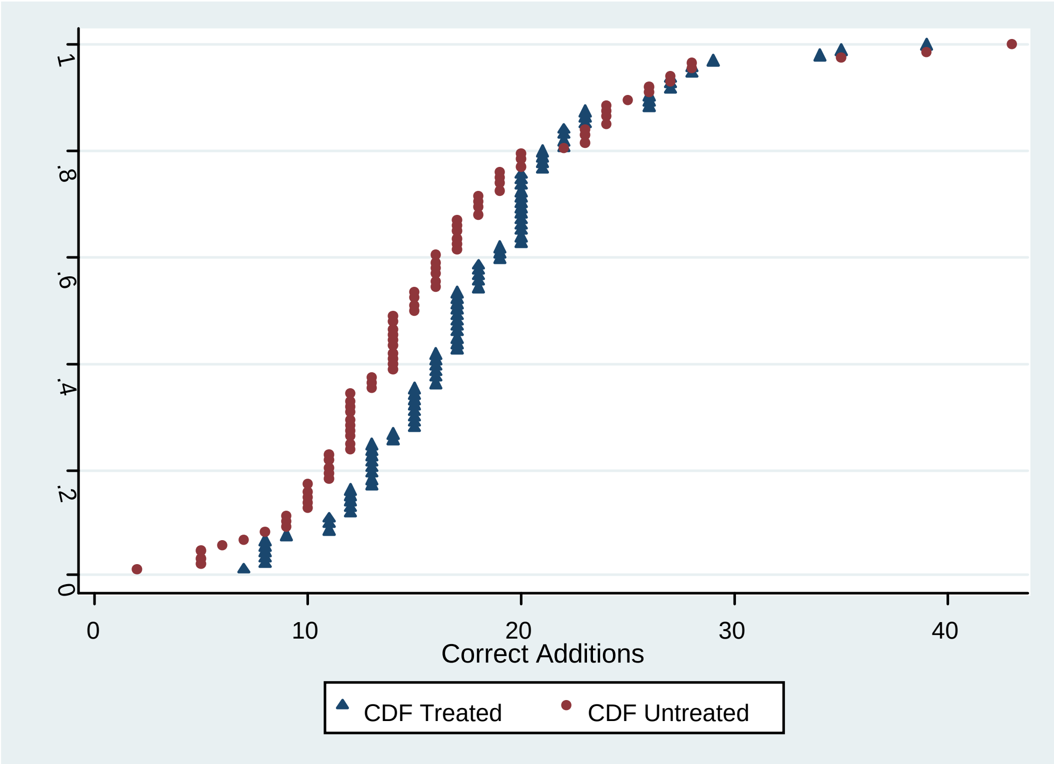

Table 1: Subject numbers for each session and day

	Day	Treated	Untreated
Main Sessions			
	1	24	24
	2	23	20
	3	23	24
	4	24	25
Extra Sessions	5	25	25
	6	23	21

Table 2: Data description

Variable	#Observations	Mean	Std Error	Min	Max
#Correct Additions	182	17.09	6.62	2	43
Happiness Before	182	4.55	1.03	1	7
Happiness After	94	5.45	0.74	3	7
GMAT MATH	182	3.43	1.38	0	5
High School Grades	178	0.49	0.25	0	1
Enjoyment-of-Clip	94	5.93	0.68	5	7

Definitions

The measure called "High School Grades" asks students to consider all of their qualifications and gives a percentage of those qualifications that are at the highest possible grade. It therefore measures their past performance against the highest possible performance. More precisely, on the questionnaire we asked two questions:

"How many school level qualifications have you taken (including GCSEs, A-levels and equivalent)?" (forming the denominator)

"How many of these qualifications were at the best grade possible? (eg A in GCSE, A is A-level, etc.)"* (forming the numerator)

Table 3: Determinants of subjects' performance[13]

	(1) log(Additions)	(2) log(Additions)	(3) log(Additions) *Treated only*
Treatment	0.118**		
	(0.0548)		
Change-in-Happiness		0.101**	0.0847*
		(0.0405)	(0.0495)
GMAT MATH score	0.104***	0.100***	0.0739***
	(0.0226)	(0.0226)	(0.0273)
High School Grades	0.471***	0.477***	0.428***
	(0.114)	(0.114)	(0.124)
Male	-0.0257	-0.0267	0.00675
	(0.0609)	(0.0606)	(0.0774)
Day 2	-0.0169	0.000901	-0.0170
	(0.0790)	(0.0787)	(0.0905)
Day 3	0.0975	0.106	0.131
	(0.0779)	(0.0776)	(0.0885)
Day 4	0.0118	0.00724	-0.00752
	(0.0762)	(0.0758)	(0.0895)
Constant	2.106***	2.120***	2.244***
	(0.105)	(0.102)	(0.126)
Observations	178	178	93
R-squared	0.273	0.280	0.307

Std errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[13] Within the table, the notation *** indicates p<0.01, ** p<0.05, * p<0.1, and standard errors are given in parentheses.

Table 4: Determinants of subjects' performance [Non-logged]

	(1)	(2)	(3)	(4)
	Additions	Additions	Additions	Additions
		(no outliers)		(no outliers)
Treatment	1.336	1.572**		
	(0.889)	(0.825)		
Change-in-Happiness			1.316**	1.407**
			(0.657)	(0.608)
GMAT MATH score	1.286***	1.291***	1.243***	1.244***
	(0.367)	(0.343)	(0.366)	(0.342)
High School Grades	8.284***	8.349***	8.355***	8.429***
	(1.854)	(1.710)	(1.844)	(1.701)
Male	0.824	0.606	0.828	0.607
	(0.988)	(0.919)	(0.982)	(0.914)
Day 2	0.472	-0.325	0.693	-0.0707
	(1.281)	(1.193)	(1.276)	(1.187)
Day 3	2.105*	2.330**	2.212*	2.455**
	(1.264)	(1.173)	(1.258)	(1.167)
Day 4	0.868	0.809	0.814	0.749
	(1.236)	(1.140)	(1.230)	(1.134)
Constant	6.603***	6.602***	6.680***	6.763***
	(1.697)	(1.575)	(1.657)	(1.535)
Observations	178	176	178	176
R-squared	0.245	0.283	0.253	0.290

Std errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5: Determinants of attempts

	(1) Log(Attempts)	(2) Log(Attempts)
Treatment	0.0911**	
	(0.0417)	
Change-in-Happiness		0.0812***
		(0.0308)
GMAT MATH score	0.0758***	0.0733***
	(0.0172)	(0.0171)
High School Grades	0.372***	0.377***
	(0.0869)	(0.0863)
Male	-0.0165	-0.0170
	(0.0463)	(0.0460)
Day 2	0.0198	0.0340
	(0.0600)	(0.0597)
Day 3	0.133**	0.140**
	(0.0592)	(0.0589)
Day 4	0.0767	0.0732
	(0.0579)	(0.0576)
Constant	2.432***	2.441***
	(0.0795)	(0.0776)
Observations	178	178
R-squared	0.279	0.288

*** $p<0.01$, ** $p<0.05$, * $p<0.1$ Std errors in parentheses

Table 6: Determinants of the precision (ie. ratio of correct answers)

	(1) Correct/ Attempt	(2) Correct/ Attempt
Treatment	0.0128	
	(0.0185)	
Change-in-Happiness		0.0102
		(0.0138)
GMAT MATH score	0.0165**	0.0162**
	(0.00765)	(0.00767)
High School Grades	0.0656*	0.0663*
	(0.0386)	(0.0386)
Male	0.00152	0.00134
	(0.0206)	(0.0206)
Day 2	-0.0268	-0.0249
	(0.0267)	(0.0267)
Day 3	-0.0201	-0.0192
	(0.0263)	(0.0263)
Day 4	-0.0507*	-0.0512**
	(0.0258)	(0.0257)
Constant	0.753***	0.755***
	(0.0354)	(0.0347)
Observations	178	178
R-squared	0.095	0.096

Std. errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

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APPENDIX: PART 1

Replication of the findings on subsamples

Table A1: Treatment Dates

The main experiment was carried out on four separate days, as follows:

Session	Treatment	Date	Time
1	Treatment 0	21 May 2008	2.30-3.30pm
1	Treatment 1	21 May 2008	4.00-5.00pm
2	Treatment 0	18 June 2008	2.30-3.30pm
2	Treatment 1	18 June 2008	4.00-5.00pm
3	Treatment 1	10 October 2008	2.30-3.30pm
3	Treatment 0	10 October 2008	4.00-5.00pm
4	Treatment 1	15 October 2008	2.30-3.30pm
4	Treatment 0	15 October 2008	4.00-5.00pm

Treatment 0 is the control treatment without a video clip and treatment 1 includes a video clip. Sessions 1 and 2 were undertaken in term 3 of the University of Warwick academic year 2007-8, while sessions 3 and 4 were undertaken in term 1 of the 2008-9 academic year. Since they are separated by a gap of approximately 4 months, we might wish to check for significant changes across the time between sessions 1-2 and sessions 3-4. The aggregate variables results broken down by session are as follows:

Table A2: Summary Statistics by Treatment

Session	Additions	Log Additions	Additions Male	Additions Female	Happy before	Happy after	Enjoy clip
1 Treatment 0	15.38**	1.17	14.88**	16.83	4.54	na	na
1 Treatment 1	18.21**	1.23	18.26**	18.00	4.54	5.63	5.96
2 Treatment 0	16.85	1.18	19.41	13.00*	4.45	na	na
2 Treatment 1	16.48	1.19	16.36	16.58*	4.43	5.22	5.74
3 Treatment 0	16.26*	1.16	15.75*	17.14	4.79	na	na
3 Treatment 1	19.52*	1.27	20.42*	18.11	4.48	5.39	5.83
4 Treatment 0	16.04	1.15	18.07	14.36	4.92	na	na
4 Treatment 1	17.72	1.22	19.6	15.92	4.36	5.44	6.21

The key column is perhaps *log additions* (the log of the number of correct additions) which somewhat smoothes outliers in the number of correctly answered numerical additions. The data for sessions 1-2 are very similar to those from sessions 3-4. Importantly, the pattern of results seems strongly consistent across sessions. The only exception comes in session 2 where the raw number of additions does not rise moving from control treatment 0 to happiness treatment 1. As explained, this is down to one outlier. Using logs brings the results into line with those from the other sessions.

We put an asterisk when the difference between treated and untreated groups is statistically significant. In particular, we have that for session 1 (21 May 2008) and session 3

(10 October 2008) the difference for the entire pool is already statistically significant at *p*-values 0.047 and 0.052 respectively. When we split the group into males and females, we note that, even in these small subsamples of raw data, there is a statistically significant finding individually in 3 out of 8 sub-cases.

Alternatively, we also regressed the key variables for all four sessions individually:

Table A3: Session Regressions (Log Additions)

VARIABLE	(1) Log Add.	(2) Log Add.	(3) Log Add.	(4) Log Add.	(5) Log Add.	(6) Log Add.	(7) Log Add.	(8) Log Add.
Treatment	0.129		0.0931		0.184		0.0979	
	(0.0889)		(0.124)		(0.127)		(0.118)	
GMAT score	0.0799*	0.0859*	0.115**	0.110**	0.139***	0.135***	0.0739	0.0722
	(0.0472)	(0.0453)	(0.0507)	(0.0510)	(0.0434)	(0.0448)	(0.0473)	(0.0469)
High Sc. Gr.	0.482**	0.486**	0.398	0.386	0.277	0.332	0.657***	0.652***
	(0.198)	(0.192)	(0.261)	(0.266)	(0.262)	(0.262)	(0.239)	(0.236)
Male	-0.0729	-0.0373	0.113	0.0985	-0.153	-0.150	-0.0258	-0.0350
	(0.111)	(0.110)	(0.127)	(0.126)	(0.134)	(0.136)	(0.136)	(0.133)
Ch.-in-happ.		0.126**		0.0256		0.0993		0.0980
		(0.0585)		(0.112)		(0.102)		(0.0792)
Constant	2.220***	2.165***	2.022***	2.093***	2.219***	2.256***	2.122***	2.128***
	(0.187)	(0.185)	(0.218)	(0.198)	(0.184)	(0.184)	(0.170)	(0.163)
Observations	48	48	40	40	41	41	49	49
R-squared	0.286	0.323	0.288	0.278	0.336	0.315	0.264	0.278

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses

Regression (1) considers *log additions* from session 1 regressed on treatment, with (2) instead using change-in-happiness. This is in general a better measure of the hedonic impact since it allows for those subjects who did not gain in happiness from watching the clip. Columns (3) and (4) are the respective regressions for session 2, (5) and (6) for session 3, and (7) and (8) for session 4. We might also consider merging sessions 1 and 2, and merging sessions 3 and 4:

Table A4: Grouped Session Regressions (Log Additions)

VARIABLES	(1) Log Additions	(2) Log Additions	(3) Log Additions	(4) Log Additions
Treatment	0.0989		0.139	
	(0.0712)		(0.0848)	
GMAT MATH score	0.100***	0.0987***	0.111***	0.108***
	(0.0333)	(0.0330)	(0.0316)	(0.0318)
High School Grades	0.458***	0.462***	0.468***	0.479***
	(0.157)	(0.155)	(0.169)	(0.169)
Male	0.0299	0.0309	-0.0658	-0.0720
	(0.0797)	(0.0789)	(0.0918)	(0.0916)
Change-in-happiness		0.0990*		0.0982
		(0.0535)		(0.0617)
Constant	2.091***	2.096***	2.147***	2.174***
	(0.135)	(0.130)	(0.122)	(0.118)
Observations	88	88	90	90
R-squared	0.268	0.281	0.274	0.273

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses

In Table A4, regressions (1) and (2) group together sessions 1 and 2. Similarly, regressions (3) and (4) group together sessions 3 and 4. As in Table A3, the first regression in each pair considers *Treatment*.

APPENDIX: PART 2

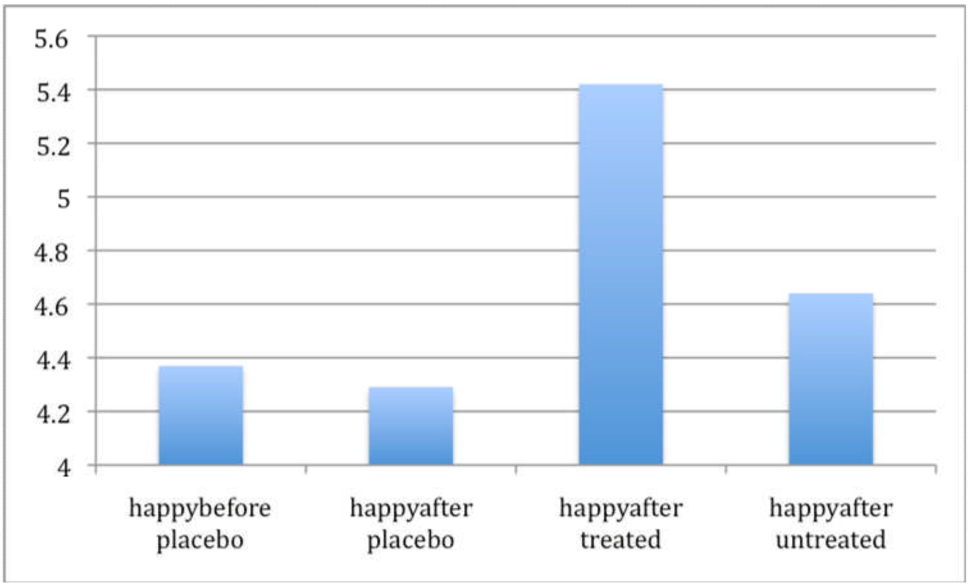
Checking the effects of a placebo film and of exact numerical payment

This describes Day 5 (3/12/08): session 1 (placebo, 25 subjects), session 2 (explicit payment and treatment, 25 subjects) and Day 6 (14/01/09), session 1 (explicit payment and no treatment), session 2 (explicit payment and treatment).

Placebo film

In the figure below we present the level of reported happiness after and before the placebo. The placebo film had the effect of very slightly reducing subjects' happiness but the two levels are not statistically different (p=0.39). The level of reported happiness after the placebo is slightly lower than the one of the non treated group (p=0.093), and statistically lower than the one in the treated group (p<0.001). All in all, the placebo film does not have a statistically significant impact on the level of self-reported happiness when compared against the non treated group.

The placebo film has, if anything, a negative impact on performances, although this difference is statistically non-significant (p=0.19). This finding is shown in table A5, where we can see that placebo treatment has no effect on additions, attempts or precision.



Explicit payment

Here we announced that each subject would be rewarded with £0.25 for each correct addition. In table A5 we introduce the dummy Explicit Payment, this is equal to 1 where the payment is specified, 0 otherwise. We interact this term with the variable Treatment to check whether this could threaten our previous finding. If the interacted term is negative and significant, this would imply that happiness has less or no impact when the payment is specified. From the first regression on table A5, we note that the interacted term Treatement*ExPayment is not statistically different from 0 (*p*=0.60), while the payment when introduced alone (2nd regression in table A5) is positive, although not significant at the 10 percent level. Similar results are obtained when we consider (log) attempts as a dependent variable (3rd and 4th regressions). Finally we also note that explicit payment has a positive but insignificant effect on precision (5th regression).

Table A5 The Effects of Placebo Film and Explicit Payment

VARIABLES	(1) Log Additions	(2) Log Additions	(3) Log Attempts	(4) Log Attempts	(5) Correct/ Attempts
Treatment	0.123**	0.112**	0.0935**	0.0986**	-0.000874
	(0.0569)	(0.0496)	(0.0458)	(0.0399)	(0.0170)
Explicit Payment	0.105	0.0747	0.0119	0.0262	0.0237
	(0.0952)	(0.0557)	(0.0767)	(0.0446)	(0.0191)
Treatment*ExPayment	-0.0461		0.0216		
	(0.117)		(0.0939)		
Placebo film	-0.0553	-0.0612	-0.0761	-0.0733	0.000595
	(0.0879)	(0.0865)	(0.0707)	(0.0696)	(0.0297)
GMAT Math score	0.0897***	0.0894***	0.0751***	0.0752***	0.0142**
	(0.0186)	(0.0185)	(0.0148)	(0.0148)	(0.00632)
High School Grades	0.455***	0.458***	0.377***	0.375***	0.0664**
	(0.0977)	(0.0971)	(0.0786)	(0.0780)	(0.0333)
Male	0.0308	0.0299	0.0206	0.0210	0.0129
	(0.0501)	(0.0500)	(0.0404)	(0.0402)	(0.0172)
Constant	2.147***	2.153***	2.464***	2.462***	0.736***
	(0.0782)	(0.0769)	(0.0624)	(0.0614)	(0.0262)
Observations	268	268	269	269	269
R-squared	0.247	0.247	0.259	0.259	0.062

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses

APPENDIX: PART 3

Description of Procedures

This part of the appendix includes a full set of subject instructions, a copy of the GMAT MATH-style test, and the questionnaire.

Instructions

[**bold** = only for the comedy clip/placebo treatment; *italics* = explicit payment variant; X directly addresses; Y, Z, etc. are assistants. Parts in square brackets are descriptive.]

[X invites subjects to enter room **while Y sets up the video clip]**

Welcome to the session. My name is X, and working with me today are Y, Z, etc. Many thanks for attending today. You will be asked to perform a small number of very minor tasks and will be paid both a show-up fee and an amount based on how you perform, **but first we would like to ask you to watch a video clip.** Please do not talk to each other at any stage in the session. If you have any questions please raise your hands, but avoid distracting the others in the room.

Z will now guide you to the seats at the front of the room directly in front of the projector, while Y prepares the video clip. Please make yourselves comfortable: the clip will last about 10 minutes and I will have more instructions for you afterwards.

[10 minutes: video clip]

Thanks for watching. Z will now distribute ID cards to you and you are asked to sit at the computer corresponding to the ID number. Everything is done anonymously – your performance will simply be recorded based on the ID card, and not your names. You will find some paper and a pen next to your computer – use them if you wish, and raise your hand if you wish to request additional paper. Please do not use calculators or attempt to do anything other than answer the questions through mental arithmetic. If we observe any form of cheating it will invalidate your answers and you will be disqualified, and therefore receive only the show-up fee.

For the first task you will have 10 minutes to add a sequence of numbers together and enter your answers in the column labelled “answer”. To remind you, you will be paid based on the number of correct answers that you produce. *at the rate of £0.25 per correct answer* When the ten minutes are over I will ask you to stop what you are doing and your results will be saved.

Next look at your screens: you will find that a file called "Numberadditions.xls" is open but minimized on your screen. Please now maximize the file by clicking on the tab. You have ten minutes starting now.

[10 minutes: number additions]

Please stop what you are doing, your answers will now be saved. Y and Z will now visit your computers and place a sheet faced down next to your keyboards. Please do not turn over the sheet until I ask.

[Y and Z move to terminals, placing question sheets faced down]

For the second task we would like you answer a small number of questions. You can maximize the file on your computer labelled "GMAT MATH.xls" and you will once again see a column labelled answers. In this column you will have to enter a letter from (a) to (e), corresponding to a multiple-choice answer to the sheet which is faced-down in front of you. Once again, I remind you that you will be paid based on the number of correct answers *at the rate of £0.50 per correct answer*. You have 5 minutes to attempt these questions, please turn over the sheets and begin.

[5 minutes: GMAT MATH-style test]

Please stop what you are doing, your answers will now be saved. You should next open the final document: a questionnaire that you are asked to complete. You will be given 10 minutes to complete this, though if you need additional time we can extend this deadline indefinitely. Please answer as truthfully as you can and feel free to raise your hands if anything is unclear. To stress, where you are asked to input a number from 1 to 7, "7" is the high number and "1" is the low one.

[10 minutes: questionnaire]

Hopefully you have all had a chance to complete the questionnaire. If you need more time, then please raise your hand. Otherwise we will save your questionnaire replies.

The central computer has calculated your payments. Please remain at your computer for the time being. I will ask you to approach the front in order of your ID numbers and you will need to sign a receipt for your payments and to hand in both your ID cards and the test document before receiving payment. Many thanks for taking part in today's session.

[Test documents destroyed, ID cards collected, receipts signed and payments handed out]

FOR REFEREES ONLY

NOT FOR PUBLICATION

GMAT MATH-style Test

Questions

Please answer these by inserting the multiple choice answer a, b, c, d or e into the GMAT MATH spreadsheet on your computer.

1. Harriet wants to put up fencing around three sides of her rectangular yard and leave a side of 20 feet unfenced. If the yard has an area of 680 square feet, how many feet of fencing does she need?

a) 34
b) 40
c) 68
d) 88
e) 102

2. If $x + 5y = 16$ and $x = -3y$, then $y =$

a) -24
b) -8
c) -2
d) 2
e) 8

3. If “basis points” are defined so that 1 percent is equal to 100 basis points, then 82.5 percent is how many basis points greater than 62.5 percent?

a) .02
b) .2
c) 20
d) 200
e) 2,000

4. Which of the following best completes the passage below?

In a survey of job applicants, two-fifths admitted to being at least a little dishonest. However, the survey may underestimate the proportion of job applicants who are dishonest,

because——.

a) some dishonest people taking the survey might have claimed on the survey to be honest.

b) some generally honest people taking the survey might have claimed on the survey to be dishonest.

c) some people who claimed on the survey to be at least a little dishonest may be very dishonest.

d) some people who claimed on the survey to be dishonest may have been answering honestly.

e) some people who are not job applicants are probably at least a little dishonest.

5.People buy prestige when they buy a premium product. They want to be associated with something special. Mass-marketing techniques and price-reduction strategies should not be used because ——.

a) affluent purchasers currently represent a shrinking portion of the population of all purchasers.

b) continued sales depend directly on the maintenance of an aura of exclusivity.

c) purchasers of premium products are concerned with the quality as well as with the price of the products.

d) expansion of the market niche to include a broader spectrum of consumers will increase profits.

e) manufacturing a premium brand is not necessarily more costly than manufacturing a standard brand of the same product.

Questionnaire

Questionnaire for Treatment 1.

Questionnaire	
Please insert your answers into the shaded boxes to the right	
Details	
What is your age?	
Are you a 1st year, 2nd year, 3rd year, graduate student, or other? (1/2/3/G/O)	
What is your gender? (M/F)	
The Clip	
How much did you enjoy the clip shown at the beginning? (1-7)	
Note: 1 is completely disliked, 2 very disliked, 3 is fairly disliked, 4 is neither enjoyed nor disliked, 5 is fairly enjoyed, 6 is very enjoyed, 7 is completely enjoyed	
Happiness	
How would you rate your happiness before seeing the clip? (1-7)	
Note: 1 is completely sad, 2 is very sad, 3 is fairly sad, 4 is neither happy nor sad, 5 is fairly happy, 6 is very happy, 7 is completely happy	
Did the clip shown at the beginning make you feel happier? (yes/no)	
IF SO:	
How would you rate your happiness after seeing the clip (1-7)?	
Note: 1 is completely sad, 2 is very sad, 3 is fairly sad, 4 is neither happy nor sad, 5 is fairly happy, 6 is very happy, 7 is completely happy	
School Record	
Have you taken GSCE or equivalent in maths? (yes/no)	
IF SO:	
What was the highest grade possible for this course? (A/A*/etc.)	
What was your grade?	
Give a percentage if you know it	
Have you taken A-level or equivalent in maths? (yes/no)	
IF SO:	
What was the highest grade possible for this course?	
What was your grade?	
Give a percentage if you know it	
How many school level qualifications have you taken (including GCSEs, A-levels and equivalent)?	
How many of these qualifications were at the best grade possible? (eg A* in GCSE, A is A-level, etc.)	
University Record	
Are you currently or have you ever been a student (yes/no)	
If yes, which degree course(s)?	
If you are a second or third year student what class best describes your overall performance to date? (1/2.1/2.2/3/Fail)	

Note: For days 5-6 we also added the following questions to the end of the questionnaire for the treated group (including the placebo treatment): (1) Did you try your best when asked to add numbers? (2) If so, why? If not, why not? (3) Did you feel that first observing the video clip made you better or worse at adding up numbers? (4) Can you say why you believe that?

Questionnaire for Treatment 0 (untreated group).

Questionnaire
Please insert your answers into the shaded boxes to the right

Details

What is your age?

Are you a 1st year, 2nd year, 3rd year, graduate student, or other? (1/2/3/G/O)

What is your gender? (M/F)

Happiness

How would you rate your happiness at the moment? (1-7)

Note: 1 is completely sad, 2 is very sad, 3 is fairly sad, 4 is neither happy nor sad, 5 is fairly happy, 6 is very happy, 7 is completely happy

School Record

Have you taken GSCE or equivalent in maths? (yes/no)

IF SO:

What was the highest grade possible for this course? (A/A*/etc.)

What was your grade?

Give a percentage if you know it

Have you taken A-level or equivalent in maths? (yes/no)

IF SO:

What was the highest grade possible for this course?

What was your grade?

Give a percentage if you know it

How many school level qualifications have you taken (including GCSEs, A-levels and equivalent)?

How many of these qualifications were at the best grade possible? (eg A* in GCSE, A is A-level, etc.)

University Record

Are you currently or have you ever been a student (yes/no)

If yes, which degree course(s)?

If you are a second or third year student what class best describes your overall performance to date? (1/2.1/2.2/3/Fail)