

Search, effort, and locus of control[☆]Andrew McGee^{a,1}, Peter McGee^{b,*}^a Simon Fraser University, Canada^b University of Arkansas, United States

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ABSTRACT

We test the hypothesis that locus of control influences search by affecting beliefs about the efficacy of search effort in a laboratory experiment. Consistent with this hypothesis, we find that reservation wages and effort are increasing in the belief that one's efforts influence outcomes when subjects are not told how search effort affects search outcomes but are unrelated to these locus of control beliefs when subjects know the relationship between effort and search outcomes. This difference in the relationship between locus of control and search behavior across treatments cannot be explained by unmeasured skill or effort costs as the search technology and offer distribution do not vary across treatments. Only the scope for locus of control to influence beliefs differs and can explain the observed difference across treatments.

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1. Introduction

Few concepts from psychology have generated as much interest among economists as locus of control, beliefs concerning the relationship between one's actions and outcomes in life (Rotter, 1966). Individuals with an external locus of control believe that outcomes are primarily matters of fate or chance. At the other extreme, individuals with an internal locus of control believe outcomes depend primarily on their own efforts. Easily measured, locus of control is correlated with earnings (Andrisani, 1977, 1981; Goldsmith et al., 1997; Osborne-Groves, 2005), educational attainment (Coleman and DeLeire, 2003; Baron and Cobb-Clark, 2010; Piatek and Pinger, 2015), health (Cobb-Clark et al., 2014) and unemployed job search (Caliendo et al., 2015; McGee, 2015). In spite of the widespread interest in locus of control, *how* locus of control influences behavior is not well understood. While psychologists envision locus of control influencing behavior through beliefs about the efficacy of effort, the documented effects of locus of control could result from its correlation with unobserved dimensions of human capital, personality, or effort costs.

In this study, we aim to identify the mechanism through which locus of control influences behavior. Specifically, we examine the relationship between locus of control and search behavior in a laboratory experiment in which subjects “search”

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by exerting effort that influences the stochastic process through which monetary offers are generated. Key to our study is the fact that the laboratory allows us to control what subjects know about the return to effort. In the “uncertainty” treatment, subjects search in an environment where the benefit to their effort is not made clear to them, while subjects in the “certainty” treatment are fully aware of the relationship between effort and the process by which offers are generated. We hypothesize that in the uncertainty treatment internal subjects who believe their actions influence outcomes will believe the rate of return to effort to be higher than their less internal peers. Conditional on any amount of effort, more internal individuals should believe themselves more likely to receive an offer than less internal searchers and set higher reservation wages as a result. Likewise, more internal individuals should perceive the marginal benefit to search effort to be higher than less internal individuals and exert more effort. By contrast, we expect locus of control to have no effect on behavior in the certainty treatment when there is no uncertainty about the relationship between effort and outcomes.

The experimental design is straightforward. Subjects participated in a search episode lasting 21 periods. Subjects earned an outside option in any period in which they searched. In each period, subjects had the opportunity to perform tasks—the experimental analog of search effort—that increased the probability that they received an offer. If an offer was received and was greater than or equal to the subject's reservation wage for that period, the offer was accepted and the subject received that amount in each subsequent period (i.e., their search ends). If a subject did not receive an offer or the offer was less than the reservation wage, the subject continued searching in the next period. In the uncertainty treatment, subjects were not informed of the relationship between completed tasks and the probability of receiving an offer, while in the certainty treatment they were made aware that each completed task increased the probability of receiving an offer by four percentage points. The distribution of potential offers was common knowledge in all search episodes. After the search episode, subjects were surveyed concerning their background, locus of control, personality traits, risk preferences, and cognitive ability.

Consistent with our hypotheses, we find that more internal subjects reported believing that effort had a larger positive effect on their chances of receiving an offer than less internal subjects in the uncertainty treatment. We also find that reservation wages and effort are positively related to internality in the uncertainty treatment: a one-standard deviation increase in internality is associated with an estimated increase in reservation wages of 9.5% and an estimated increase of 0.72 items completed (subjects averaged approximately 10 items per period). By contrast, we find no evidence that locus of control is related to reservation wages or effort in the certainty treatment.

Caliendo et al. (2015) and McGee (2015) find that internality is positively related to search effort and reservation wages among unemployed job seekers in Germany and the United States, respectively. More internal job seekers, however, may expend more effort and hold out for higher wages because they are, in fact, better at searching or because they know that skills correlated with locus of control and unobserved by econometricians make them more desirable to employers than less internal individuals. Alternatively, more internal individuals may be less bothered by expending effort on search. These alternative explanations for the correlations between locus of control and search behavior cannot generally be ruled out using survey data, but they also cannot explain the differences observed across treatments in our experiment in which the only difference between the treatments is what subjects know about the return to effort. The only explanation that can rationalize our findings is that locus of control influences search behavior through an effect on beliefs about the efficacy of effort.

Studying the connection between beliefs about the return to effort and job search is, in part, motivated by the phenomenon of discouraged workers who enter long-term non-employment because they no longer believe that they can find a job (Schweitzer and Smith, 1974). Surprisingly, discouragement presents itself in this short experiment as in 10% (4%) of subject-period observations in the uncertainty (certainty) treatment subjects “quit” in that they either choose to complete no tasks or stop attempting tasks before their time allotment expires. We find that this phenomenon is related to locus of control as external subjects are more likely to “quit” than their more internal peers.

The laboratory provides an excellent methodological tool to study labor markets because it affords the experimenter control over the labor market environment (Falk and Fehr, 2003; Charness and Kuhn, 2011). Early studies of search with exogenous offer arrival rates (Braunstein and Schotter, 1981, 1982; Cox and Oaxaca, 1989) exploited this control to demonstrate that the predictions of job search models with respect to reservation wages are borne out in the laboratory, while more recent experimental studies have investigated how factors such as wait times (Brown et al., 2011) and self-image (Falk et al., 2006) influence subjects' search decisions. In this vein, ours is the first study to leverage the control afforded by the laboratory to examine the mechanism through which locus of control affects search and other labor market activities. Only by understanding the mechanisms through which locus of control and other psychological constructs influence behavior can economists and policy-makers begin to turn knowledge of the correlations between these constructs and economics outcomes into useful policy recommendations in job search and other domains. While we have job search in mind, our findings provide insight into how locus of control affects decision-making in settings ranging from investment to spousal search to consumer search. Specifically, our findings suggest that in any setting in which the return to effort is uncertain, locus of control will influence both how much effort the individual exerts and how selective the individual is—insights which have important practical implications. For instance, marketers might wish to target external individuals who exert less effort searching on their own or “de-bias” internal individuals to induce them to purchase rather than holding out for a “steal.” We leave investigation of the types of “nudges” appropriate for individuals with different locus of control beliefs for future research.

2. Experimental design and data

2.1. Experimental design

Undergraduates at Simon Fraser University participated in sessions lasting about 90 min each. In every session, subjects completed a search episode lasting 21 periods and a short questionnaire. In the search episode, subjects searched in every period for wage offers by supplying real effort and set binding reservation wages determining which potential offers they would accept. Accepting an offer ended the search episode with the subject earning the accepted offer in all remaining periods.

In periods prior to and including the period in which an offer was accepted, subjects earned an outside option of 15 experimental currency units (ECUs); ECUs were converted to dollars at the end of the experiment at a rate of 50 ECUs to CD\$1. Subjects only earned ECUs in the 21st period (during which there was no search) if they had accepted offers in an earlier period. The wage offers generated by search effort were drawn from a discrete distribution. Specifically, the offer set was {5, 10, 15, 20, 35, 40, 45} and the probabilities associated with each offer conditional on receiving an offer were $\Pr(5)=0.25$, $\Pr(10)=0.25$, $\Pr(15)=0.25$, $\Pr(20)=0.10$, $\Pr(35)=0.05$, $\Pr(40)=0.05$, and $\Pr(45)=0.05$.² The offer distribution and the basic structure of the search episode were explained to subjects in the instructions (provided in the online appendix) prior to the experiment. Subjects participated in one of two treatments: the “uncertainty” treatment in which the process by which offers were generated was not explained to subjects and the “certainty” treatment in which this process was explained in detail. We elaborate on the difference between the treatments below.

At the beginning of each period before an offer had been accepted, subjects “searched” by performing a coding task. Subjects were given a key matching 10 words to 10 four-digit numbers. The key was followed by seven multiple choice questions, each listing a word and five four-digit numbers with the correct answer being the four-digit number corresponding to the word in the key. After completing a set of seven questions, subjects moved on to a new set of word-number pairings and questions (“items”). Screenshots of the interface used by subjects in the uncertainty and certainty treatments are provided in the online appendix. Subjects had 90 s to correctly code as many items as they could—though they were not required to complete any items and could exit the coding task if they wished. We use the coding task because of the limited skill involved: subjects need only be able to read as the correct answer for every item is given in the key. Limiting the subjects to 90 s was a practical necessity, but the time-limit likely increased the extent to which performance depends on the effort exerted. Subjects completed a trivially easy task. The time limit forced subjects to expend effort to move quickly. A subject could exert no effort and complete no items; completing 20 or more items required that the subject exert a great deal of effort.

The number of items correctly coded in a period determined the probability of receiving an offer in that period. In both treatments, each item correctly coded increased the probability of receiving an offer by four percentage points:

$$\Pr(\text{offer}_t = 1) = \begin{cases} 0.04 * (\# \text{ of items correctly completed}) & \text{if } \# \text{ of completed items} \leq 25 \\ 1 & \text{otherwise} \end{cases}$$

In the uncertainty treatment, subjects were not told how correctly coded items affected the probability of receiving an offer. Subjects were only told that, “The number of items you complete in the word coding task may affect whether or not you receive an offer during a period.” In the certainty treatment, subjects were explicitly informed of the relationship between correctly coded items and the probability of receiving an offer, and the rate at which correctly coded items increased the probability of receiving an offer appeared on their screen at all times.

Following the coding task in the uncertainty treatment, subjects were asked three questions. First, “How many items do you think you correctly completed?” Second, “What do you think are the chances that you will receive an offer in this period?” Answer choices included “no chance,” “very unlikely,” “unlikely,” “a 50–50 chance,” “likely,” “very likely,” and “I definitely expect to receive an offer.” Third, “If you receive an offer in this period, what would the offer have to be for you to accept it?” Answers to this third question were binding: a wage offer greater than or equal to the reservation wage was automatically accepted, while an offer less than the reservation wage was rejected. Subjects were advised to think carefully about their responses to this question given the effect it would have on their earnings.

After answering these questions, subjects learned whether they had received an offer, the amount of the offer, and whether or not the offer (if one was received) was accepted based on their response to the earlier question. If subjects accepted offers, their search episodes ended. If they did not receive an offer or received an offer less than their reservation wage, they moved to the next period and repeated this process, beginning with the coding task. Subjects moved from period to period until they had accepted an offer. If no offer had been accepted by the end of the 20th period, the search episode ended and subjects were paid the outside option for 20 periods. The certainty treatment proceeded in the same fashion, but subjects were not asked their beliefs about the probability of receiving an offer.

² We use an offer distribution in which most offers are less than or equal to the outside option for two reasons. First, getting a job in the labor market may be easy, but getting a good job can be quite hard, which is reflected in the offer distribution. Second, this distribution ensures that we collect more observations as more offers are rejected and subjects search in more periods.

After the search episode, subjects in both treatments completed a questionnaire including the four-item Rotter Internal–External Locus of Control Scale used in the NLSY79 (Rotter, 1966), a Big Five inventory measuring extraversion, agreeableness, conscientiousness, emotional stability, and imaginativeness or intellect (Goldberg, 1992), the Rosenberg Self-Esteem Scale (Rosenberg, 1965), and a survey measure of generalized optimism versus pessimism (Scheier et al., 1994). In addition, subjects were asked questions concerning demographics and how many hours per week they spent playing video games (a proxy for their skill using the coding interface). Subjects then completed the low-stakes risk preference measure from Holt and Laury (2002), risk preference survey measures from the German Socioeconomic Panel (GSOEP) and the Health and Retirement Survey (HRS), and a measure of cognitive ability consisting of the three questions from the Cognitive Reflection Test (CRT; Frederick, 2005) and three questions from the Wonderlic Personnel Test (Wonderlic and Hovland, 1939) where subjects earned CD\$0.50 for each correct answer.³ Finally, subjects in the uncertainty treatment were asked what effect they believed completing an additional coding task had on the probability of receiving an offer. The answer choices included “decreased my chances of receiving an offer by a lot,” “decreased my chances. . . by a little,” “had no effect on my chances. . .,” “increased my chances. . . by a little” and “increased my chances. . . by a lot.” The questionnaire components are provided in the online appendix.⁴

The optimal search effort levels (s_t) and reservation wages (w_t^r) in each period t depended on the subject-specific, unobserved search costs ($c(s_t)$), but we can obtain comparative static predictions for how locus of control ought to be related to effort and reservation wages in the two treatments. When subjects receive an outside option ($w^0 = 15$) in every period that they actively search but are uncertain about the return to search effort, λ , they should choose search effort and reservation wages to maximize the expected present value of search $E(V_t^S)$ (presumably without discounting):

$$E(V_t^S) = w^0 - c(s_t) + \tilde{\lambda} s_t \Pr(w \geq w_t^r) (21 - t) E\{w | w \geq w_t^r\} + (1 - \tilde{\lambda} s_t \Pr(w \geq w_t^r)) E(V_{t+1}^S)$$

where the subjective estimate of the return to effort $\tilde{\lambda} = E(\lambda | \{s_j\}_{j=1}^{t-1}, \{offer_j\}_{j=1}^{t-1}, X)$ depends on prior search effort choices, outcomes ($Offer_t = 1$ indicates that an offer is received in period t), and individual characteristics X that inform the searcher's prior beliefs regarding the return to search effort. Subjects should update away from this prior as they acquire search experience, but the characteristics X —which include locus of control—will have a persistent effect on behavior to the extent that prior beliefs continue to affect behavior.

Similar to the labor contracts model of Bowles et al. (2001), we assume that the estimate of the return to search effort is increasing in one's sense of control, internality (i.e., $\partial \tilde{\lambda} / \partial \text{locus} > 0$ where locus is increasing in internality). Caliendo et al. (2015) and McGee (2015) show that more internal individuals exert more effort and hold out for higher reservation offers than less internal individuals in similar models with infinite horizons in discrete and continuous time, respectively. Conditional on search effort, more internal searchers expect to receive an offer with higher probability than do less internal searchers, so they hold out for higher offers. Similarly, more internal searchers believe the marginal return to search effort to be higher than do less internal searchers, so they exert more effort.

Proving the same comparative statics analytically is difficult in our model, but the model is easy to solve recursively given that $V_{21}^S = 0$ provided we make assumptions about search costs. Assuming that search costs are given by $c(s_t) = 0.1s_t^2$ for the purposes of illustration, Fig. 1 plots the optimal effort levels and reservation wages in each period for different values of $\tilde{\lambda}$ in the neighborhood of the true marginal return to search effort ($\lambda = 0.04$).⁵ As evident from the figure, reservation wages are increasing in the expected marginal return to search $\tilde{\lambda}$, and the optimal effort level is increasing in $\tilde{\lambda}$ provided the constraint $s_t < 1/\tilde{\lambda}$ is not binding at the optimal effort level.⁶ If this constraint binds and searchers believe the probability of receiving an offer given their effort to be one or nearly one, an increase in internality—and hence the expected marginal productivity of search—leads to a decrease in search effort. Increasing internality under our assumptions has the same effect as increasing $\tilde{\lambda}$ and thus in most cases leads to higher reservation wages and search effort when the return to search effort is uncertain.

The primary virtue of our experimental design is that the wage distribution and technology by which offers are generated are identical across treatments. The only difference between the two treatments—thus the only potential cause for a different

³ In Section 3, we use the GSOEP measure to control for risk preferences. The GSOEP question asks, “Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Rate yourself from 0 to 10, where 0 means ‘unwilling to take any risks’ and 10 means ‘fully prepared to take risks.’” We reverse-code this measure to be increasing in risk aversion. We use this as our preferred measure of risk preferences given that deleting inconsistent responses to the HL measure would result in missing data for 28.8% of our sample due to subjects with more than one switch point. The HRS risk preference measure asked subjects about their willingness to take a gamble that would double or otherwise reduce their household income, but undergraduates oftentimes have no income and hence no frame of reference. The results presented in section III are not sensitive to the choice of risk measure.

⁴ Administering the questionnaire before the search episode risked “priming” the subjects and influencing their behavior, while administering the questionnaire after the search episode risked the possibility of reverse causality if subjects' experiences in the experiment influenced their responses to the locus of control questions. Cobb-Clark and Schurer (2011), however, show that locus of control largely does not respond to important life events using data from Australia. Moreover, Doyle et al. (1977) show that locus of control is not affected by an experimental task in which actual control over outcomes is low. With this in mind, we administered the locus of control questionnaire after the treatments.

⁵ Solving the model using any cost function of the form $c(s_t) = as_t + bs_t^2$ for any values of a and b results in optimal reservation wage and effort response functions resembling those in Fig. 1. The reservation wages depicted in the figure represent the upper bound of the set of reservation wages between which the searcher would be indifferent in light of the discrete nature of the offer distribution.

⁶ In the experiment, this condition ($s_t > 25$) only binds in 11 out of 2662 observations.

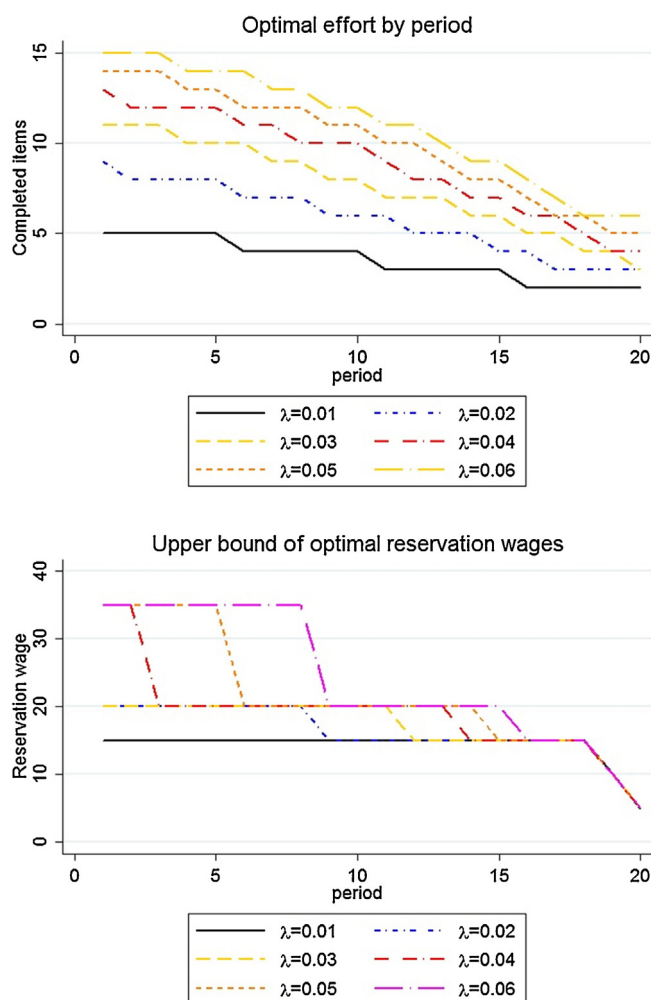


Fig. 1. Optimal effort levels and reservation wages by period. *Notes:* The graphs depict the optimal effort levels and the upper bound of the optimal reservation wages by period at different expected marginal productivities of search. These solutions were derived given $c(s_t) = 0.1s_t^2$. Similar graphs result from the choice of any cost function of the form $c(s_t) = as_t + bs_t^2$.

relationship between locus of control and search behavior across treatments—is what subjects know about the technology through which offers are generated. In the uncertainty treatment, subjects know nothing about the relationship between their effort and the probability of receiving an offer. As such, there is scope for their general beliefs about the relationship between effort and outcomes—their locus of control beliefs—to influence their behavior as outlined above. By contrast, subjects know exactly how their effort affects outcomes in the certainty treatment, and thus there is no obvious role for locus of control beliefs to play in the certainty treatment. As such, we expect that internality will be positively correlated with reservation wages and search effort in the uncertainty treatment and uncorrelated with these choices in the certainty treatment.

2.2. Data

The sessions are summarized in Table 1. Subjects were paid a flat CD\$9 show-up fee in addition to their earnings from the search episode, the Holt-Laury instrument, and the cognitive ability questions. In total, 189 subjects provided 1486

Table 1
Summary of experimental sessions.

Session type	Number of subjects	Number of sessions	Observations	Average earnings
Uncertain	189	20	1486	\$21.65 (4.03)
Certain	158	21	1176	\$22.31 (4.09)
Total	347	41	2662	\$21.95 (4.07)

Note: Standard deviations in parentheses.

Table 2
Summary statistics.

	Treatment		
	Uncertainty	Certainty	<i>p</i> -Value
<i>Dependent variables</i>			
Elicited belief about likelihood of an offer in a period	0.56 (1.62)		
Reservation wage	23.69 (23.04)	22.89 (11.27)	0.69
Correctly completed items	9.90 (4.32)	9.52 (4.44)	0.42
Fraction of “quits”	0.10	0.04	0.00
Number of subject-period observations	1486	1176	
Elicited belief about effect of completing item on probability of an offer	0.80 (0.76)		
<i>Control variables</i>			
Locus of control	11.16 (2.50)	11.82 (2.34)	0.01
Willingness to take risks	4.18 (1.89)	3.75 (2.04)	0.04
Optimism–pessimism	20.71 (4.52)	21.59 (4.19)	0.06
Self-esteem	36.04 (6.13)	37.17 (6.40)	0.09
Extroversion	31.56 (6.21)	31.76 (6.11)	0.76
Agreeableness	37.56 (5.78)	38.55 (5.55)	0.11
Conscientiousness	33.75 (6.10)	34.25 (5.64)	0.43
Emotional stability	29.99 (7.22)	30.44 (7.23)	0.56
Openness/intellect	33.14 (4.59)	34.67 (4.60)	0.00
Cognitive ability	2.28 (1.52)	2.32 (1.58)	0.83
Weekly hours of video games	5.08 (11.06)	3.83 (6.60)	0.21
Male	0.44	0.57	0.02
Number of subjects	189	158	

Notes: The *p*-values in the third column are for *t*-tests of the equality of the means in the two treatments. Responses to the elicited beliefs about likelihood of an offer in a period were on a 7-point Likert scale where –3 corresponded to “There is no chance at all that I will receive an offer,” 0 to a “50–50 chance,” and 3 to “I definitely expect to receive an offer,” while the responses to the elicited belief about effect of completing item on probability of an offer were on a 5-point Likert scale where –2 corresponded to “decreased my chances of receiving an offer by a lot,” 0 to “had no effect,” and 2 to “increased my chances of receiving an offer by a lot.” Locus of control is increasing in internality. The risk preference measure is increasing in risk aversion. Optimism–pessimism is increasing in optimism (decreasing in pessimism). The cognitive ability measure consists of the three questions in the cognitive reflection test (CRT) and three questions taken from the Wonderlic test. The score reflects how many of these six questions were answered correctly. The control variables are standardized within the sample to have mean zero and standard deviation one in the subsequent tables. The questions can be found in the online appendix.

subject-period observations in the uncertainty treatment, and 158 subjects provided 1176 subject-period observations in the certainty treatment. The average per subject earnings from all parts of the experiment was CD\$21.95.

Table 2 reports the summary statistics for the variables used in the analysis by treatment as well as the *p*-value for the test of the equality of the means across treatments where appropriate. Subjects in the uncertainty treatment believed on average that the chances of receiving an offer in a period were slightly greater than 50–50 (which would correspond to a score of 0). This suggests that subjects were overly optimistic about the probability of receiving an offer given that in both treatments subjects completed nearly 10 items on average, which would imply a probability of around 0.4. Despite not being told the explicit relationship between effort and the probability of receiving offers, subjects in the uncertainty treatment on average reported that they believed completing an item “increased my chances of receiving an offer by a little” given that this response corresponds to a value of 1 when the mean response was 0.80.⁷ That average beliefs in the uncertainty treatment were essentially correct likely explains why the mean reservation wages and effort levels were statistically indistinguishable in the two treatments.

The remainder of Table 2 reports the raw scores for the control variables; we standardize the controls within the sample to have mean zero and standard deviation one in the regression analysis to facilitate comparisons of the effects of different

⁷ Only 7 out of the 189 subjects indicated that they believed completing more items would decrease their chances of receiving an offer “by a little” or “by a lot.”

variables on behavior. Consistent with earlier research (Becker et al., 2012), internality is significantly and positively correlated in our sample with all of the Big Five personality traits except for agreeableness. Internality is also correlated with optimism (0.48) and self-esteem (0.54), but weakly correlated with risk aversion (-0.005) and cognitive ability (-0.05). One could imagine a role for all of these traits in search. For example, a searcher may believe that the probability of receiving an offer is $a + \lambda s_i$, where a is the probability of receiving an offer independent of effort. As a searcher's expectation regarding a increases, the searcher will hold out for higher offers, but search effort will not be affected as the marginal return to search effort remains the same. If optimism is positively correlated with beliefs about a , then omitting optimism introduces a positive omitted variables bias in the estimated coefficient of locus of control in reservation wage models.

Our between-subject design introduces the possibility that the uncertainty and certainty samples are unbalanced in terms of unobserved subject characteristics. Indeed, the p -values testing the equality of the means across treatments indicate that the samples are unbalanced in terms of subjects' observed locus of control beliefs, risk preferences, optimism, self-esteem, openness, and gender. A particular strength of our study, however, is that we control for a much larger set of characteristics than most studies using survey data, which reduces the likelihood that important unobserved subject traits remain that are unbalanced across samples and correlated with locus of control beliefs. We discuss this issue further in the next section.

3. Findings

3.1. Locus of control and beliefs

We begin by presenting evidence concerning the relationship between locus of control and beliefs in the uncertainty treatment given that the goal of the experiment is to establish whether locus of control influences behavior through beliefs about the relationship between effort and outcomes. Columns 1 and 2 of Table 3 report estimated marginal effects from probit models of subjects' beliefs about the likelihood of receiving an offer in any period before an offer had been accepted as a function of their locus of control beliefs, other characteristics, and a linear time trend.⁸ In all of the tables discussed in this section, we report standard errors clustered at the subject level. The estimated marginal effect in column 1 indicates that a one standard deviation increase in internality is associated with a 1.8 percentage point increase in the likelihood that a subject believes he has a better than 50–50 chance of receiving an offer, a positive but not statistically significant relationship. The dependent variable here, however, reflects beliefs about outcomes, and our hypothesis is related to the relationship between locus of control and beliefs about the connection between effort and outcomes. As such, in column 2 we add the number of items correctly completed and its interaction with locus of control to the model. Though not statistically significant, the positive marginal effect for the interaction between locus of control and the number of items completed implies that only subjects who were more internal than average believed that completing more items would lead to higher probabilities of receiving an offer given that the coefficient estimate for the main effect of items completed is essentially zero.⁹ This approach is similar to that used by Caliendo et al. (2015), who found that the interaction between locus of control and the number of applications submitted by German job seekers was positively correlated with the job seeker's reported belief concerning the probability of receiving an acceptable job offer.

The above analysis provides weak evidence that locus of control is related to how effort influences beliefs about outcomes. To directly examine the relationship between locus of control and beliefs about the return to effort rather than beliefs about outcomes, we simply asked subjects at the end of the uncertainty treatment what effect they believed completing an additional item had on the probability of receiving an offer. The last column of Table 3 presents the estimated marginal effects from a probit model of the beliefs about the effect of completing one more item on the probability of receiving an offer, and the results are striking.¹⁰ Evaluating the other controls at their means, a one standard deviation increase in internality is associated with a 10.4 percentage point increase in the probability that a subject believed that completing one more item increased their chances of receiving an offer. Subjects' beliefs about the marginal effect of completing an item—the return to effort—are clearly increasing with internality.

⁸ The dependent variable in columns 1 and 2 collapses answers to the question, "What do you think the chances are that you receive an offer this period?" into a binary outcome. Responses of "no chance," "very unlikely," "unlikely," or "50–50 chance" were coded as 0; responses of "likely," "very likely," and "I definitely expect to receive an offer" were coded as a 1. In the online appendix we report coefficients for ordered probit models using all response categories for all specifications in Table 3. The results are similar.

⁹ In McGee and McGee (2011), subjects reported beliefs about the likelihood of receiving an offer as a probability between 0 and 1 rather than choosing responses on a Likert scale. The estimates in Table 3 are qualitatively similar to the earlier estimates, but the interaction between items completed and locus of control was statistically significant at the 5% level in the earlier version. In those estimates, each item completed increased the subject's belief that he would receive an offer by 0.7 percentage points for a subject with a locus of control one standard deviation above the mean.

¹⁰ The dependent variable is constructed by collapsing answers to the question, "I thought that completing an additional item..." into a binary outcome. Responses of "...decreased my chances of receiving an offer by a lot," "...decreased my chances of receiving an offer by a little," and "...had no effect on my chances of receiving an offer" were coded as 0; responses of "...increased my chances of receiving an offer by a little" and "...increased my chances of receiving an offer by a lot" were coded as a 1.

Table 3
Marginal effects in probit models of elicited beliefs.

Variable	Dependent variable		
	Belief about likelihood of an offer in a period		Belief about the effect of completing an item on the probability of an offer
	(1)	(2)	(3)
Locus of control	0.018 (0.038)	−0.019 (0.072)	0.104** (0.043)
Correctly completed items		−0.001 (0.005)	
Correctly completed items × locus of control		0.003 (0.005)	
Risk aversion	−0.047* (0.027)	−0.048* (0.027)	−0.008 (0.038)
Optimism–pessimism	0.008 (0.038)	0.008 (0.038)	−0.040 (0.047)
Self-esteem	−0.011 (0.040)	−0.010 (0.040)	0.034 (0.052)
Extroversion	0.053 (0.033)	0.054 (0.033)	0.030 (0.044)
Agreeableness	−0.019 (0.038)	−0.020 (0.038)	0.001 (0.038)
Conscientiousness	0.036 (0.033)	0.035 (0.033)	0.021 (0.039)
Emotional stability	−0.040 (0.035)	−0.041 (0.035)	0.008 (0.040)
Openness/intellect	−0.001 (0.032)	−0.001 (0.032)	−0.036 (0.040)
Cognitive ability	−0.005 (0.033)	−0.004 (0.034)	−0.030 (0.035)
Male	0.100 (0.063)	0.094 (0.066)	−0.082 (0.077)
Weekly hours of video games	0.016 (0.022)	0.017 (0.022)	0.013 (0.035)
Period	−0.003 (0.004)	−0.004 (0.004)	

Notes: Standard errors in parentheses are clustered at the subject-level. For columns 1 and 2, the dependent variable is constructed by collapsing the answers to the question, “What do you think the chances are that you receive an offer this period?” into a binary outcome. Responses of “no chance,” “very unlikely,” “unlikely,” or “50–50 chance” were coded as 0; responses of “likely,” “very likely,” and “I definitely expect to receive an offer” were coded as a 1. For column 3, the dependent variable is constructed by collapsing the answers to the question, “I thought that completing an additional item. . .” into a binary outcome. Responses of “. . .decreased my chances of receiving an offer by a lot,” “. . .decreased my chances of receiving an offer by a little,” and “. . .had no effect on my chances of receiving an offer” were coded as 0; responses of “. . .increased my chances of receiving an offer by a little” and “. . .increased my chances of receiving an offer by a lot” were coded as a 1. The marginal effects are evaluated at the sample means.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

3.2. Reservation wages and search effort

When subjects are unsure of the marginal return to search effort as in the uncertainty treatment, we expect more internal searchers to set higher reservation wages and exert more search effort. When the marginal return to search effort is known as in the certainty treatment, we do not expect to observe any relationship between internality and reservation wages and search effort. To test these hypotheses, we estimate for both treatments log-reservation wage and search effort models by OLS with the full set of controls listed in Table 2 and linear time trends.^{11,12} Table 4 reports the coefficient estimates by treatment as well as the *p*-value for the Wald test of equal coefficients across treatments for each control variable. Consistent with our hypotheses, internality is positively related to reservation wages in the uncertainty treatment and unrelated to reservation wages in the certainty treatment (*p*-value 0.047). A one standard deviation increase in internality is associated with an estimated increase in reservation wages of 9.5% in our uncertainty sample. By contrast, Caliendo et al. (2015) and McGee (2015) find that one standard deviation increases in internality are associated with increases in reservation wages of 1.5 and 1.1%, respectively. The substantially larger effect of locus of control in our experimental setting likely reflects the fact that in real search individuals are typically not wholly ignorant of the job market and understand—in many cases from experience—how their search effort affects outcomes, leaving a circumscribed role for locus of control in determining

¹¹ In the uncertainty (certainty) treatment, subjects set their reservation wages equal to zero in 6 (0) of 1486 (1176) subject-period observations. We set these reservation wages equal to 1 prior to taking logs. The inclusion of these observations has no effect on our estimates.

¹² More flexible time trends yield similar estimates.

Table 4
Coefficient estimates for log-reservation wage and search effort models.

Variable	Dependent variable					
	Log-reservation wage			Number of items completed		
	Uncertainty (1)	Certainty (2)	p-Value (3)	Uncertainty (4)	Certainty (5)	p-Value (6)
Locus of control	0.095** (0.040)	−0.020 (0.042)	0.047	0.723** (0.338)	−0.566 (0.363)	0.010
Risk aversion	−0.022 (0.028)	−0.034 (0.031)	0.756	−0.102 (0.317)	0.774** (0.388)	0.081
Optimism–pessimism	−0.025 (0.045)	0.033 (0.040)	0.340	0.242 (0.453)	−0.482 (0.354)	0.209
Self-esteem	−0.076* (0.040)	0.058 (0.049)	0.036	−0.335 (0.409)	0.490 (0.372)	0.137
Extroversion	−0.054 (0.039)	−0.025 (0.036)	0.578	0.154 (0.370)	0.092 (0.364)	0.905
Agreeableness	−0.044 (0.034)	−0.007 (0.028)	0.400	0.204 (0.356)	−0.130 (0.335)	0.494
Conscientiousness	−0.024 (0.034)	0.032 (0.035)	0.260	0.441 (0.270)	0.341 (0.326)	0.813
Emotional stability	−0.008 (0.048)	−0.016 (0.040)	0.908	−0.205 (0.360)	0.018 (0.343)	0.655
Openness/intellect	0.084*** (0.032)	−0.021 (0.045)	0.057	0.273 (0.317)	0.203 (0.352)	0.882
Cognitive ability	0.110*** (0.033)	0.062* (0.032)	0.298	0.701** (0.341)	1.112*** (0.322)	0.370
Male	0.152* (0.082)	0.165** (0.079)	0.908	−1.406** (0.624)	−0.381 (0.645)	0.254
Period	−0.008 (0.005)	0.006 (0.004)	0.028	0.001 (0.051)	0.167*** (0.045)	0.016
Weekly hours of video games	0.044 (0.031)	−0.042 (0.030)	0.046	0.412** (0.203)	−0.522* (0.289)	0.009
Constant	2.998*** (0.056)	2.962*** (0.061)	0.777	12.065*** (0.453)	11.093*** (0.496)	0.149
R ²	0.127	0.090		0.068	0.171	
Subject-period observations	1486	1176		1486	1176	

Notes: Standard errors in parentheses are clustered at the subject-level. The models are estimated by ordinary least squares. The p-values in columns 3 and 6 are for the tests of the equality of the coefficients in the two treatments.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

beliefs about the connection between job search effort and outcomes. In the uncertainty treatment, however, subjects have no idea how effort is related to outcomes and no prior experience to draw upon when forming their expectations. As such, locus of control likely plays a more significant role in determining behavior in our experimental setting than in actual job search.¹³ When searchers know exactly how effort affects outcomes in the laboratory—the certainty treatment—there is no statistically significant relationship between locus of control and reservation wages.

The evidence from survey data concerning the relationship between search effort and locus of control is limited by the difficulty of measuring job search effort in surveys. That is, should one measure effort using the number of search methods used (e.g., help wanted ads, referrals by friends, placement services), the number of job applications submitted (Caliendo et al., 2015), the number of hours per week spent searching (McGee, 2015), or some other measure? By contrast, search effort is well-defined in our experiment, and the estimates in column 4 suggest that internality is positively correlated with effort in the uncertainty treatment and negatively correlated with effort in the certainty treatment (p-value of the test of equal coefficients 0.010). A one standard deviation increase in internality is associated with an estimated increase of 0.723 items in the uncertainty treatment—a considerable increase given that subjects on average complete around 10 items.¹⁴ Though not statistically significant at conventional levels, we speculate that the negative correlation between internality and effort

¹³ Another potential explanation for the smaller effect of locus of control in the field is that wage offers faced by any given searcher in the field generally vary much less than in our experiment, where the largest possible wage offer is nine times the smallest possible wage offer.

¹⁴ As discussed in Section 2.1, increasing internality could lead to reductions in effort if very internal subjects believe the marginal return to effort to be so high that they need to supply little effort. In estimates available from the authors, however, we allowed the effect of locus of control on search effort to be non-linear and found that, if anything, internality has the largest positive effect on effort among very internal individuals—suggesting that few such subjects believed the marginal return to effort to be so high that they needed to supply little effort. This is also why in Fig. 1 we consider changes in $\tilde{\lambda}$ in the neighborhood of the true value of λ .

in the certainty treatment could stem from a positive correlation between internality and overconfidence if overconfident individuals believe they need to complete fewer items to get an offer.¹⁵

Overall, our findings support the hypothesis that locus of control influences search behavior through beliefs. When subjects are uncertain about the return to effort as in the uncertainty treatment, general beliefs about the return to effort (locus of control) influence search decisions. When subjects know the return to search effort, there is no such role for general locus of control beliefs, and we find little evidence of an effect of locus of control on search decisions. A potential limitation of the between-subjects design of the current study, however, is that like earlier studies using survey data there may be important missing variables correlated with locus of control that influence search such as overconfidence. Differences in the effects of locus of control across treatments could be the result of differences across treatments in the subjects' unobserved characteristics. In an earlier version of the paper (McGee and McGee, 2011), however, we reported the findings from an experiment similar to that in the current study using a within-subject design in which the unobservables were necessarily balanced across treatments. In the specifications most similar to those used in this study, we found that the estimated coefficients of locus of control in the uncertainty treatment were 0.083 and 0.743 in the log-reservation wage and search effort models, respectively, while locus of control was unrelated to search decisions in the certainty treatment.¹⁶ Collectively, the two studies provide robust evidence that locus of control beliefs influence search behavior through their effect on beliefs about the return to search effort.

3.3. Discouragement

The Bureau of Labor Statistics defines discouraged workers to be those individuals who “were not currently looking for work specifically because they *believed* no jobs were available for them or there were none for which they would qualify.” Following the 2008 recession, the number of discouraged workers in the United States rose by more than 70% in 2009 to 717,700 (Bureau of Labor Statistics, 2009). Incorporating a role for discouragement in a search model, Blundell et al. (1998) identify discouraged workers to be those for whom the costs of search outweigh the *expected* benefits. In this section, we examine whether locus of control is related to discouragement—extreme effort withdrawal that we term “quitting”—among our subjects insofar as internality under our hypothesis directly influences the expected benefits of search.

Defining “quitting” in any period to mean that either the subject completed no items or stopped coding before the end of the 90-s coding window, we observed quitting in 10 (4) percent of subject-period observations in the uncertainty (certainty) treatment.¹⁷ Table 5 reports the estimated marginal effects from a complementary log–log model of the probability of quitting by treatment using the same controls as in Table 4. Complementary log–log models are often recommended when the distribution of the outcome is skewed such that there is a high proportion of zeroes in the dataset as is the case for quitting in our dataset (Cameron and Trivedi, 2005). In the uncertainty (certainty) treatment, a one standard deviation increase in internality is associated with a reduction in the predicted probability of quitting in any period of 2.9 (0.7) percentage points.¹⁸ While only statistically significant at the 10% level, locus of control is the only control that predicts quitting in the uncertainty treatment other than the period.¹⁹ Although the marginal effects of locus of control are relatively different across the two treatments, the infrequency with which quitting occurs results in large standard errors such that we cannot reject the equality of the marginal effects in the two treatments.

Falk et al. (2006) study search in an experiment in which the effectiveness of search depends on subjects' type. Subjects are uncertain about their type—the real world analog of which would be their relative ability or desirability to potential employers—which they learn about through experience searching, which is costly. Unlucky initial search experiences lead some subjects to infer their type to be “lower” than it actually is and quit searching prematurely believing the costs to outweigh the expected benefits. Searchers become discouraged by dint of rational Bayesian updating. Our findings also suggest that discouragement can result from uncertainty about the return to search, but this uncertainty need not concern one's type. Instead, discouragement may result from a behavioral bias that inclines external searchers to believe search effort to be less effective than it actually is at the outset of their search episode. Unlucky search experiences can reinforce this bias and lead external searchers to give up.²⁰

¹⁵ Changes in sample composition could influence our findings as some subjects contributed more observations than others depending on the period in which the subject accepted an offer. To examine this possibility, we estimated the models in Table 4 restricting the sample to the first 10 periods. The estimated coefficients of the locus of control in the reservation offer and search effort regressions are 0.054 and 0.410, respectively. While smaller than the estimates using the full sample, the change in the sample composition over the experiment does not drive our findings.

¹⁶ The within-subjects design required that the uncertainty treatment always be run before the certainty treatment. As a result, the differences in the estimated relationships between locus of control and reservation wages and search effort could be due to order or learning effects. The fact that we obtain very similar estimates in the between-subjects design, however, suggests that this was not the case.

¹⁷ Subjects could exit the coding task at any time by clicking a “Stop” button. Because a period only ended when all subjects still searching finished the coding task, quitting did not reduce subjects' time in the lab.

¹⁸ Quitters were not quitting because they thought themselves guaranteed an offer as only 49% of quitters responded that they had better than a 50–50 chance of receiving an offer. Among quitters, 22%—all from the uncertainty treatment—believed that they would definitely receive an offer.

¹⁹ We observed substantially more quitting and found locus of control to be much more highly correlated with quitting behavior using the within-subjects design in our earlier paper (McGee and McGee, 2011). We speculate that fatigue may have played a bigger role in that design given that the sessions were considerably longer, and this fatigue may have inclined subjects to quit with more regularity.

²⁰ In estimates available from the authors, we find that the positive association between internality and search effort is stronger in the later periods of the experiment. Consistent with our findings concerning quitting, internal searchers may be less likely to become discouraged and continue to exert high

Table 5

Estimated marginal effects from a complementary log–log model of the probability of “quitting”.

Variable	Uncertainty (1)	Certainty (2)	p-Value (3)
Locus of control	−0.029 [*] (0.017)	−0.007 (0.005)	0.682
Risk aversion	0.007 (0.014)	−0.003 (0.005)	0.430
Optimism–pessimism	−0.025 (0.019)	0.008 (0.006)	0.044
Self-esteem	0.011 (0.026)	−0.005 (0.006)	0.410
Extroversion	−0.003 (0.017)	0.000 (0.005)	0.838
Agreeableness	0.005 (0.022)	−0.002 (0.006)	0.718
Conscientiousness	−0.000 (0.016)	−0.002 (0.006)	0.854
Emotional stability	0.029 (0.018)	−0.004 (0.006)	0.113
Openness/intellect	−0.010 (0.014)	−0.013 ^{**} (0.006)	0.146
Cognitive ability	−0.004 (0.016)	−0.012 (0.008)	0.152
Male	0.029 (0.018)	0.021 ^{**} (0.009)	0.337
Period	0.008 ^{***} (0.002)	−0.001 (0.001)	0.010
Weekly hours of video games	−0.022 (0.014)	0.001 (0.003)	0.154
Subject-period observations	1486	1176	

Notes: Standard errors in parentheses are clustered at the subject-level. The marginal effects are evaluated at the sample means. The *p*-values in column 3 are for the tests of equality of the marginal effects in the two treatments. There were 148 instances of quitting in the uncertainty treatment and 45 in the certainty treatment.

^{*} Significant at 10%.

^{**} Significant at 5%.

^{***} Significant at 1%.

That unlucky experiences might reinforce external beliefs leading to discouragement is not inconsistent with the findings of Falk et al. The difference between our findings, however, has important implications for programs attempting to prevent job seekers from becoming discouraged. Identifying job seekers who will be unlucky in the sense that conditional on their search effort and desirability to potential employers they will receive fewer offers than they could reasonably expect is a fool's errand. Identifying job seekers who are relatively external and hence at risk of becoming discouraged, on the other hand, is relatively easy with a short questionnaire and could prove to be a viable approach to targeting resources at unemployed job seekers most in need of assistance—or simply encouragement.

4. Discussion and conclusion

Despite growing interest in so-called “soft skills” like sociability and personality (e.g., Borghans et al., 2008; Lundberg, 2013), economists often remain agnostic about what these measures of soft skills actually measure and how they influence behavior (e.g., Heckman et al., 2006). The laboratory provides economists the opportunity to identify what these instruments actually measure and how they influence behavior—precisely the goal of this study concerning locus of control.

If locus of control affects beliefs about the efficacy of effort—as psychologists believe it does—then internal job seekers will set higher reservation wages and exert more effort looking for work. Consistent with these hypotheses, internality is positively related to reservation wages and search effort among unemployed job seekers in survey data. Alternative explanations for the positive correlations between internality and reservation wages and search effort such as correlations between internality and unobserved human capital or search costs, however, cannot be ruled out using survey data. Our experimental design allows us to rule out these alternative explanations by holding constant the search technology and wage distribution faced by all subjects. Subjects participate in two treatments: one in which the return to effort is uncertain and one in which the return to effort is common knowledge. A clear treatment difference emerges: more internal subjects exert more effort and hold out for higher wages than less internal subjects when the return to effort is uncertain, but there is no difference in behavior associated with internality when the return to effort is common knowledge. That locus of control

search effort as the search episode goes on, while external searchers may become discouraged and search even less than they did before. The latter effect would lead to the bigger, positive correlation between internality and search effort that we observe in the later periods.

influences search behavior through beliefs about the efficacy of effort is further evident from the fact that subjects' self-reported beliefs about the effect of search effort on the probability of receiving an offer are increasing in their internality. Internal individuals search harder than less internal individuals because they believe this effort is more likely to lead to an offer, and because they expect offers to be more likely conditional on effort they hold out for higher offers.

Understanding how locus of control affects behavior in this abstract search setting has two benefits. First, economists can incorporate this understanding of how locus of control influences behavior into models of decision-making in a broad range of contexts. Any decision requiring an individual to expend effort when the payoff to that effort is uncertain could be affected by locus of control beliefs. Second and more importantly, knowing how locus of control affects behavior can guide policy to help individuals overcome behavioral biases that may hinder their employment prospects. Some job training programs have sought to help participants develop a more internal locus of control and increase their general sense of self-efficacy (Dextraze, 1986; Eden and Aviram, 1993). While encouraging job seekers to take charge of their affairs is undoubtedly a good thing among external job seekers who would otherwise remain on the couch, increasing the internality of job seekers is not an unambiguously welfare-enhancing intervention given the effect internality has on reservation wages. Very internal job seekers may “make the perfect the enemy of the good” and hold out for excessively high wages. Moreover, determining which job seekers are *too* internal or *too* external in the context of job search would be nearly impossible.

The only way to increase the expected utility of job seekers is to properly “calibrate” their beliefs about the efficacy of search. Many job seekers—especially young people with little experience looking for work—have no idea how much or how hard to search. They may rely on their general perceptions of how the world works—i.e., general locus of control and optimism–pessimism beliefs—when choosing how much effort to put into search. Providing job seekers with information about how the job market works and how much effort others exerted in job searches in similar occupations or industries may reduce their reliance on general beliefs when forming beliefs about the job market and lead to better decisions.

Evidence from both the lab and the field suggests that fairly minimal counseling for job seekers can be effective. In our earlier paper using a within-subject design (McGee and McGee, 2011), we reported estimates from a treatment in which subjects were provided with information concerning the experiences of prior subjects. While the samples were small, the estimates provided no evidence that locus of control beliefs influenced subjects' reservation wages and effort choices when subjects were given this information concerning the experiences of other subjects. Similar interventions in the field have also demonstrated the usefulness of minimal counseling. In a recent field experiment in Germany, Altmann et al. (2015) show that providing newly unemployed individuals most at risk of long-term-unemployment with encouragement and information on job search strategies and the consequences of unemployment through a simple brochure was associated with significant increases in employment and earnings in the year following the intervention. In light of the demonstrated effectiveness of minimal counseling, our findings imply that providing inexperienced job seekers with information about the successful job search strategies of others seeking similar jobs may be a straightforward and effective way to eliminate some of the uncertainty about job search that allows general beliefs like locus of control to influence—possibly in a detrimental way—job search.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.jebo.2016.03.001>.

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