"You just can't get better at creativity":

Categorising skill proficiency as a product of 'traits' or 'training'

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Author's note: We note that this study was possible due to authors being brought together through the StudySwap platform (https://osf.io/view/studyswap/).

Keywords: Implicit Theories, Perceptions of Ability, Individual Differences, Creativity, Physical Activity, Education, Housework

Running title: Skills as Traits or Training

Abstract

Research on ‘implicit theories’ of intelligence and ability suggests that individuals tend to be predominantly more ‘entity’ or fixed (skill is invariant over time), or ‘incremental’ or growth (abilities are improvable and changeable) in terms of their beliefs about the nature of intelligence. However, there have been few investigations of participants’ willingness to make these implicit theories explicit across a range of capabilities. Here, we investigate the responses participants give when asked to categorize Schooling, Creative, Physical fitness or Home skills as the product of the ‘traits’ an individual has or the ‘training’ they receive as part of life experience and development. Participants also completed individual differences measures of held implicit theories of intelligence. A total of 488 participants from the UK and US completed the study. On average, 26% of the skill judgments were categorised as ‘trait’. The categorisations varied by skill, with the skills ironing (11.90%) and chemistry (12.10%) receiving the fewest ‘trait’ categorisations and the skills of singing (63.20%), drawing (63.20%), and painting (57.70%) receiving the most. In general, the Creativity domain received the highest average trait endorsement (39.71%). Participants’ self-report fixed implicit theories of intelligence also predicted the number of trait categorisations they made. The results are discussed in the context of research indicating the possible implications on outcomes of domain-specific beliefs.

Introduction

Individuals differ in their beliefs of how we acquire skills throughout our life. Some individuals have a tendency to believe that one can continually develop and grow skills throughout life, without limit. Others are more prone to believe that general affinity for skills are fixed from birth or very early life experiences and no amount of training could improve performance. The academic literature on this topic has largely been led by research into “implicit theories”: Internal belief mechanisms that a person might use to structure their understanding of the world. A large body of research has focused on the nature of implicit theories of personal development and intelligence (e.g..Castella & Byrne, 2015; Renaud-Dubé, Guay, Talbot, Taylor, & Koestner, 2015). Some people principally endorse an “incremental” (growth) belief, that their skills (e.g. academic performance, personality) can continually develop or change with practice and challenge. Others preferentially consider their skillset to be “entity” (fixed) and assume that there is, generally, inflexibility in their ability (e.g. intelligence, physical fitness) to change. This difference in world perception is not merely of academic interest, as Schleider, Abel, and Weisz (2015) demonstrate in their meta-analysis, those who preferentially endorsed entity beliefs about skills were more like to have mental health problems. Whilst this relationship is not causal, the malleability of implicit beliefs create more opportunities for broad intervention. Much of the implicit theories literature is based on self-report scale measures about general or task-specific beliefs. In this current study we ask participants to make a dichotomous choice about whether they consider a wide variety of skills to be more due to dispositional ability or life-course training. Our aim is to understand how participants categorize the source of differing types of skills rather than a psychometric abstraction of broad perceptions.

Since beginning data collection for the current study there have been some interesting developments in studying public perceptions of genetic dispositions and behaviour. Recent research has shown that even social psychologists are divided on the relationship between genetics and behaviour, such as genetic predisposition to aggression (Buss & von Hippel, 2018). Much more research has focused on the general public’s understanding of genetic influences on personal attributes. Gericke et al., (2017) studied young adults' beliefs in genetic determinism, using the Public Understanding and Attitudes towards Genetics and Genomics Scale (PUGGS; Carver, Castéra, Gericke, Evangelista, & El-Hani, 2017). This tool was developed to assess the public's general assumptions about the extent to which key traits are genetically influenced. Gericke et al. found that university freshmen generally considered an individual's height, colour blindness, and blood group to be genetically determined, but rarely endorsed a genetic component for someone's fashion interest, gambling addiction, and political orientation.

The PUGGS was improved and studied in more detail by Willoughby et al., (2019). They focused on the effect of political, religious, and agency beliefs on beliefs about the genetic contribution to complex behaviour. The Willoughby et al. adaptation of the PUGGS is labelled the Lay Estimates of Genetic Influence on Traits (LEGIT) tool, which asks participants to report the extent to which they believe a series of traits (i.e. personality, athleticism, musical talent, sexual orientation) are genetically, as opposed to environmentally, influenced. Willoughby et al. found that eye colour, blood group, and colour blindness were most often reported to be mostly or only genetically influenced. They also found that participants reported political beliefs, violent behaviour, and obesity to be mostly or only environmentally influenced. Willoughby and colleagues go further and relate their participants' perceptions of genetic influence on behaviour to the academic research on the genetic influence on behaviour. In their sample they found that participants' assumptions about genetic influences on the traits in the LEGIT were correlated strongly with known behavioural genetics research. Both the PUGGS and LEGIT show how students and lay people generally consider physical properties to be more genetically predetermined and social or cultural behaviours to be less so.

However, the work of both Gericke et al. (2017) and Willoughby et al. (2018) is based on the language of "genetics". The implicit theories literature, by nature, focuses on the non-technical beliefs that we implicitly hold. When focusing on a concrete, scientific, language participants may be responding differently to how they would implicitly reply. Whilst participants may not attribute behaviour to genes, they may still hold 'fixed' beliefs that skill capacity is unchangeable. Our current study is broader than the specific focus on genetics and rather focuses on giving participants more freedom to broadly define skill as attributed to general fixed 'traits' or changing 'training'. Our use of simple definitions and non-scientific terminology may change how participants present their 'fixed' and 'growth' perceptions.

To this end, we conducted a study on general perceptions of sources of skill proficiency. We asked a large sample of UK and US participants to consider whether a series of everyday skills (academic school subjects, sporting activities, general creativity, and everyday home tasks) were more likely to be predisposed from early life (a 'trait') or continually improved with time ('training). To better understand why these categorisations might emerge, we follow this study with subjective ratings of cultural representations of these skills (such as masculinity, professionalism, and world-importance). We have no clear predictions for the current study. We do expect that 'entity' (fixed, unchanging) implicit theories of intelligence (as measured using standardised measures; Abd-El-Fattah & Yates, 2006) could reflect wider entity endorsements of other skills as part of a general disposition for an entity theory of capability.

Method

Our data can be accessed on the open science framework here: https://osf.io/vbsnm/?view_only=59172535cef6479fbfbd3398207de404.

Participants. A total of 488 participants (Female= 272, Male= 210, Other/missing= 6, M_{Age}= 30.65, SD_{Age}= 11.26) were sampled through a voluntary UK sample (n= 281) and a US Amazon Mechanical Turk (n = 207) sample. The UK sample were volunteers for an online study on appraising skills. The US sample completed the study as part of a pairing of two brief studies. This second, unrelated study was to pilot test stimuli where participants made ratings of the hostility present in vignettes. This pilot study always came after participants completed their judgments for the current study and, thus, should not have influenced responses in any obvious ways.

Procedure and materials.

Traits or training? After giving informed consent, participants were presented with definitions of 'trait' and 'training' categories. Skills to be labelled as trait were those which met the following criteria.

"*There are some things that you just can't change throughout your life. Your height, for example, is generally fixed after the age of 18. There are many skills attributes that you might consider to be fixed in the long term too. For any of the skills on the following list that you consider a natural ability, that some people are just good at and some people can just never be good at, you should label trait*."

The example given is of a non-skill but individually varying property of a person. In the case of traits this was height and in the case of training this was skin tone:

"*There are some things that continue to change throughout your life. Skin tone, for example, varies, even on a day to day basis, depending on exposure to sunlight. There are many skills that you might consider to be flexible in the long term too. For any of the skills on the following list that you consider to be learnable, that a person could acquire with some practice or experience, you should label training."*

With these definitions, participants were then presented with 40 skills presented in four blocks. These skills were chosen to reflect domains often discussed in debates around implicit theories; School, Creativity, and Physical Activity. We included a further 'baseline' category of Home skills which have not been explored in the implicit theories literature. We expected these skills to be perceived as developed by 'training' due to their modernity, wide use and contextual specificity. The complete list of skills can be found in Table 1 below, grouped in their four categories. We tested the within-participant consistency of skill categorisation using the Kuder-Richardson-21 (KR21) coefficient for reliability in binary data and the more familiar, but less suited to binary data, intra-class correlation coefficient (ICC). Participants were notably consistent in their categorisation of the skills overall (KR21= .90, ICC= .91, 95% *CI* [.90, .92]) and in the School (KR21= .78, ICC= .80, 95% *CI* [.77, .83]), Creativity (KR21= .82, ICC= .87, 95% *CI* [.84, .88]), Physical Activity (KR21= .85, ICC= .87, 95% *CI* [.85, .89]), and Home (KR21= .82, ICC= .84, 95% *CI* [.82, .86]) domains. The total number of trait endorsements per domain (i.e. a score from 0 skills considered trait, to 10 skills considered trait) were retained for further analysis in the study.

Implicit Theories measures. Participants then completed two measures of individual differences in implicit theories. Although the measures focus specifically on intelligence, it is of interest to see if this one domain represents a general tendency. First, they completed Abd-El-Fattah and Yates' (2006) Implicit Theories of Intelligence Scale (ITIS). The ITIS has separate subscores of entity theories of intelligence (seven items) and incremental theories of intelligence (seven items). Further, participants completed Dweck's, (1999) four questions which are designed as indicators of entity theories of intelligence. The internal reliability for Dweck's measure was high (α= .94), but lower for the ITIS entity (α= .65) and ITIS incremental (α= .79) measures. Previous work has suggested a similar reliability value for the entity domain of the ITIS (Satchell, Hoskins, Corr, & Moore, 2017) and we find that a two-factor solution to the ITIS may not be the best fit with a confirmatory factor analysis (Tucker-Lewis Index= .72, RMSEA= .096). Future work may wish to explore the ITIS in more detail, but the current paper retains the established analysis by Abd-El-Fattah and Yates for literature continuity. Mean responses to the psychometric measures can be found in Table 2.

After completing the questionnaire, participants were thanked for their time and provided with a digital debriefing form.

Analyses. The first part of this paper focuses on descriptive reports of the number of trait endorsements. We will highlight the average and range of trait endorsements in each domain and test these against chance reporting of 50% using binomial tests.

Differences in categorisations between domains will be demonstrated using within subjects ANOVA on participants' total number of trait endorsements per domain. This is a score between 0 (participant categorises no skills of the 10 as trait) and 10 (participant categorises all skills as trait).

We will further use bivariate and partial correlations (controlling for the difference in country of origin) to indicate the extent to which the implicit theories of intelligence relate to domain trait endorsements.

Results

Trait endorsement. On average, 25.95% of all judgments made by participants were endorsements that good performance in a skill was 'trait' determined. Creativity received the greatest number of trait endorsements, with the average Creative skill receiving trait endorsements from

39.71% of the sample. This was particularly heightened with 63.11% (308 out of 488) of participants considering singing and dancing as skills to be determined by traits (see Table 1). Notably, the smallest number of trait endorsements ('ironing', see Table 1) still has approximately one in ten participants reporting that this is a skill that "*you just can't change throughout your life".* Only Art in School (p= .326), Acting (p= 1.00) and Creative writing (p= .055) in the Creative domains did not significantly differ from 50% when tested with a binomial test. All other percentages of endorsements where either significantly below 50% (indicating sample wide training endorsements) or significantly above 50% (indicating sample wide trait endorsements) with all other $p \leq .004$ (see table 1).

Table 1. *The percentage of sample who endorsed an ability as 'Trait' for each of the four domains, ordered by largest endorsement to smallest.*

School		Creativity		Physical Activity		Home	
Skill	Trait%	Skill	Trait%	Skill	Trait%	Skill	Trait%
Art Class	49.60	Singing	63.20	Sprinting	42.80	DIY	37.40
Maths	24.80	Drawing	63.20	Dancing	34.20	Tidying	34.40
English	23.80	Painting	57.70	Jogging	23.90	Bills	28.30
Languages	22.50	CreativeWriting	53.80	Football	19.30	Cooking	20.10
Physics	17.60	Acting	51.70	Swimming	20.50	Gardening	20.30
IT	14.30	Pottery	34.30	Rugby	17.50	Washing up	18.70
Geography	13.10	Drums	20.10	Tennis	17.40	Baking	17.90
History	12.30	Violin	18.40	Sit ups	14.80	Vacuuming	15.80
Biology	12.70	Piano	17.70	Cycling	15.20	Driving	12.90
Chemistry	12.10	Guitar	17.00	Push ups	14.80	Ironing	11.90
Average	20.28	Average	39.71	Average	22.04	Average	21.77

The average participant usually considered at least two skills as trait determined in each of the School, Physical Activity and Home domains and around four skills in the Creativity domain (see Table 2). Participants' total number of trait responses per domain differed between the four domains ($F(2.81, 1368.68)= 94.10$, $p< .001$, $\omega_p^2= .08$). This effect is driven by the participants reporting a higher number of skills as trait in the Creativity domain ($M_{Creativity}= 3.98$, $SD= 3.01$) compared to their responses in the School ($M_{School}= 2.03$, $SD= 2.34$, $p< .001$, $d= .72$), Physical Activity ($M_{Physcial}= 2.22$, $SD= 2.73$, $p< .001$, $d= .61$) and Home ($M_{Home}= 2.19$, $SD= 2.54$, $p< .001$, $d= .64$) domains. There were no notable differences in the comparisons between the other domains (all $p\geq .109$, all $d \leq .08$).

The average participant reported at least 10 skills, across the 40 skills in the study, as trait based. Interestingly, very few participants considered all skills in a particular domain as 'trait'. Only 0.82% of participants categorized all 10 items of Home category were all classified as trait. These 'maximum trait classifiers' were also found in the School (2.05%), Physical Activity (3.89%) and Creativity (9.84%) categories too. Again, Creativity stands out as receiving the most trait endorsement.

There were statistically significant differences between the US and UK populations in their number of trait endorsements and implicit theory psychometrics, but these differences were small in size (Table 2). As the computed overlap coefficient (see Inman & Bradley, 1989) shows that even the largest difference between groups (for Mindset) has 73% of participants presenting indistinguishably between the US and UK. In general, we do not consider there to be notable differences between groups.

Table 2. *The descriptive statistics for the Implicit theory and Domain Endorsement measures*.

	Whole Sample		UK-US Difference	UK		US	
	Mean	SD	*t* (*p*) [*d*] OVL	Mean	SD	Mean	SD
Implicit Theory Scales (Scales: 1-4)							
Entity-ITIS	2.29	0.52	-6.32 (<.001) [.58] .77	2.16	0.48	2.45	0.53
Incremental-ITIS	3.09	0.53	1.27 (=.205) [.11] .92	3.12	0.49	3.06	0.57
Mindset	2.03	0.90	-7.21 (<.001) [.66] .73	1.78	0.78	2.35	0.96
Domain Trait Endorsements (Scales: 0-10)							
School	2.03	2.34	-0.94 (=.347) [.09] .96	1.94	2.30	2.15	2.40
Creativity	3.98	3.01	-1.55 (=.122) [.14] .92	3.80	2.82	4.23	3.24
Physical Activity	2.22	2.73	-2.92 (=.004) [.27] .86	1.92	2.43	2.64	3.04
Home	2.19	2.54	-2.04 (=.042) [.19] .88	1.99	2.31	2.46	2.82
Total (Scale: 0-40)	10.42	7.81	-2.57 (=.011) [.23] .88	9.65	7.15	11.47	8.53

Notes
ITIS= Implicit Theories of Intelligence scale.
Negative *t* value indicates that US population scored higher
OVL= overlap coefficient (see Inman & Bradley, 1989) demonstrating the overlap between the two tested distributions

Implicit theories of intelligence. We correlated known measures of individual differences in implicit theories (the ITIS and Dweck's [1999] measure) with the number of trait endorsements made by the participants. Table 3 reports on these bivariate and partial (controlling for country of sample) correlations. The bivariate and partial correlations were highly similar. Overall, there was strong and consistent evidence that the entity implicit theory of intelligence measures positively correlated, and the incremental ITIS measure negatively correlated, with the number of trait endorsements. We can consider measures of implicit entity theories of intelligence to reflect explicit entity judgments of a variety of skills.

Table 3. *Bivariate and Partial correlations between the implicit theory domains and the endorsement totals, controlling for country of data collection (with p in brackets).*

Measure	School	Creativity	Physical	Home	Total Domains
Bivariate correlations					
E-ITIS	.29 (<.001)	.19 (<.001)	.24 (<.001)	.28 (<.001)	.34 (<.001)
I-ITIS	-.11 (=.013)	-.13 (=.005)	-.15 (=.001)	-.09 (=.054)	-.17 (<.001)
Mindset	.28 (<.001)	.18 (<.001)	.28 (<.001)	.27 (<.001)	.34 (<.001)
Partial Correlations controlling for country of data collection					
E-ITIS	.29 (<.001)	.17 (<.001)	.22 (<.001)	.26 (<.001)	.32 (<.001)
I-ITIS	-.11 (=.014)	-.12 (=.006)	-.15 (=.001)	-.08 (=.069)	-.16 (<.001)
Mindset	.28 (<.001)	.17 (<.001)	.25 (<.001)	.25 (<.001)	.32 (<.001)

Notes: *N*= 488, *df*= 485,
ITIS= Implicit Theories of Intelligence scale. E-ITIS= Entity subscale, I-ITIS= Incremental subscale

Discussion

The current study investigated participants' explicit categorisation of everyday skills into trait (entity, unchangeable performance) or training (incremental, malleable performance) sourced. Many of the everyday household, academic school, sports and exercise, and creative skills were considered *"a natural ability, that some people are just good at and some people can just never be good at"*. However, it was the 10 skills in the overarching Creativity domain that received the highest number of trait endorsements, suggesting that creative interests are perceived as more difficult to acquire than Schooling, Home and Physical Activity based skills. All traits, regardless of the highly specified nature of many of the skills (such as Ironing, Gardening, and Baking) received at least 12% of trait categorisations (Ironing) and at most 63% (Drawing and Singing). It was also shown that the number of trait endorsements made by an individual was related to their implicit theory of intelligence, where higher entity and lower incremental implicit theories of intelligence related to higher trait endorsements. This suggests general effects of implicit theories across specific domains.

The endorsement of school skills as trait is a well-studied phenomenon (Castella & Byrne, 2015; Renaud-Dubé et al., 2015). We find that one in five judgments of the School skills were considered to be more trait than training based. Educational settings are oft-studied in the context of implicit theories, with mixed evidence on the relationship between entity beliefs about academic performance and intellect and academic attainment (see Costa & Faria, 2018; Zhang, Kuusisto, & Tirri, 2017). Of the School domain skills, the most frequently categorised in as an entity ability was

Art Class, in line with the general treatment of Creativity as more fixed. We also found that, at best, the ITIS entity score only explains 8% of the variance in trait endorsements of School skills, despite implicit theories of intelligence measures often being used in education research as an index of implicit theories of schooling. This suggests that, whilst general correlations between the ITIS score and trait endorsement exist, there is a large amount of subject-specific variance unexplained by anchoring judgments of school performance to the term 'intelligence.' Future research may want to explore the use of 'intelligence' terminology in common implicit theories measures in school settings and beyond.

Similarly, there has been work on the performance and strategy effects of implicit theories in sports settings (Biddle, Seos, & Chatzisarantis, 2007; Ommundsen, 2001, 2003). In our current work, we found varying sample-wide endorsements of trait explanations of sports skills. Whilst some skills were considered reasonably trait (i.e. Sprinting at 43%) whereas others more generally seen as training (i.e. Cycling at 15%), despite the requirements of the activity being relatively similar. Further research could explore what is perceptually different between these different sports skills.

In the current study, the Creativity domain was distinct in receiving the most trait endorsements. Given our above findings, more research should be conducted on understanding trait-based views on creativity. Recent work has studied how entity and incremental implicit theories of creativity predict performance in a creative divergent thinking task (Warren, Mason-Apps, Hoskins, Azmi, & Boyce, 2018). Warren et al. found that those with more incremental views on creativity showed better performance on a creativity task than those with more entity views. A large review of the creativity literature finds that training can improve creative performance (Scott, Leritz, & Mumford, 2004), so individuals can improve their creative abilities and may need intervention on their implicit theories to recognise this. Other research has shown that perceptions of 'creative exemplars', particularly musicians and artists, are more likely to be perceived as to being skilled due to trait talents (as opposed to long-term training; Hass & Burke, 2016). Creativity benefits both individuals' wellbeing (Tamannaeifar & Motaghedifard, 2014) and has benefits for the economy

(Florida, Mellander, & Stolarick, 2008; Wolfe & Bramwell, 2016) so it should be considered how strategies to improve perceived accessibility of creative activity could benefit society.

There are limitations to the current work. Notably our strategy of asking the traits or training question was purposefully broad. In the work that has been published since our data collection, there has been specific focus on the role that people perceive *genetics* to have in influencing general behaviour (Gericke et al., 2017; Willoughby et al., 2018). The nuance behind our participants' judgments of traits or training could be further explored. It could be that trait endorsements could be strongly correlated with perceptions of genetics or early childhood experiences. This further exploratory detail could be explored in future work.

We also did not record the proficiency of the participants in the skills we assessed here. It could be the case that participants engage in a form of 'sympathetic endorsement' where they consider their own skills of high proficiency as more likely to be training based, and the skills they experience as more challenging trait based. Whilst proficiency could be quite easy to quantify in some of our cases (academic performance or sporting awards) our novel focus on household ability is harder to quantify.

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