

# **The Relationship between Cognitive Ability Test Scores in yr 10 students and Detached- Personal Thinking in Lessons**

Simon P Walker

Centre for Human Ecology Theory, UK

[www.humanecology.webeden.co.uk](http://www.humanecology.webeden.co.uk)

## **Abstract**

This study reviews data collected from a cohort 60 of yr 10 students at a school in the UK to identify potential correlations between learner-environment state and academic performance. The data was collected between December 2012 and December 2013.

Learner cognitive-affective state data was collected using Footprints assessment technology, which was developed on the basis of Human Ecology Theory. This assesses and models the learning strategies that a learner is deploying across their varied learning environments. The data provides the potential to understand the difference between what Walker calls 'optimal and sub-optimal cognitive-affective states'.

This study provides evidence that one measure of cognitive ability, CAT score, in yr 10 relates to the state of 'perspective' adopted by the learner in the learning environment. High CAT score students adopt more detached perspectives in their lessons whilst low performing students adopt more personal perspectives.

The outcome suggests that the Footprints construct of perspective may be related some constructs proposed within models of executive function (EF). One construct is inhibition in which one overcomes one's prepotent, or instinctive, response. A detached perspective may also improve the ability to be cognitively flexible or shift between different tasks and mental states, a second construct of executive function.

Along with prior evidence that higher set students adapt their perspective for the learning task in hand, this study suggests that a detached perspective is required for higher-order thinking such as conceptualisation, analysis and evaluation which are cognitive abilities required in all subjects.

## **Introduction: executive function and learner-environment states**

Intrinsic models of learning emphasise the intrinsic cognitive ability of the learner. Traditional IQ models, for example, assume that a learner's cognitive ability can be measured in abstract and the resulting score will hold good for the learner whatever the context he is learning in. Some authors question this assumption on cultural grounds (Berry 1993; Barber 2005), whilst many others have increasingly sought to understand cognition through a construct that can take into account ecological context and situational task ability. This is usually referred to as Executive Function (EF) (Blair 2006; Brydges et al. 2012; Bull, Scerif 2001; Gray et al. 2003).

Walker's Human Ecology Theory is an interactionist theory (2009) of learning. Human Ecology Theory regards learning as an interaction between the learner and the learning environment. Both the learner and the learning environment (constituted by peers, teacher, classroom etc) are active co-creating agents in the learning process. The cognitive strategies the learner deploys, refines and habituates must be understood as a situational response to the environmental opportunities and conditions within which he is engaged in learning. As such, they can be regarded as aspects of executive function.

One influential theory of EF was developed by Miyake and Friedman's theory of executive function proposes that there are three aspects of executive functions: updating, inhibition, and shifting (Burgess et al. 2006; Miyake et al. 2000; Friedman et al. 2006). Updating is defined as the continuous monitoring and quick addition or deletion of contents within one's working memory. Inhibition is one's capacity to supersede responses that are prepotent in a given situation. Shifting is one's cognitive flexibility to switch between different tasks or mental states.

## **Method**

### **Assessing learner-environment state**

The Footprints assessment technology, developed on the basis of Human Ecology Theory, seeks to assess and model the cognitive-affective state that a learner is deploying across their varied learning environments. The data provides the potential to understand the difference between what Walker calls 'optimal and sub-optimal cognitive-affective states'. Walker (2013 b.) claims evidence that this technology can assess and model the relative cognitive adaptation of a learner to their learning environment.

### **Assessment method**

The Footprints assessment requires candidates to complete an online computer-based imagination exercise. The exercise involves a series of verbal instructions, listened to through headphones, which invite the candidate to imagine a space in their own imagination. See appendix for further explanation. The instructions enable the candidate to form the dimensions, shape, features and activities of a space they imagine in their mind. Having created their space, the candidate is then invited to score a set of multiple choice statements about their space. These answers give a baseline score of the candidate's *actual imagined cognitive self-operation*.

### **Measuring student *actual imagined cognitive self-operation* in learning contexts**

Having established the individual's baseline scores for *imagined cognitive self-operation*, the Footprints assessment instrument then leads the candidate through three sets of further enquiries about their space. Specifically, the candidate is invited to imagine, in turn, a particular learning context taking place within their space; for example, their maths lesson, or their science lesson.

The chosen learning context is one which the candidate experiences in reality within school. For example, if they are in maths set one in school, then in the Footprints imagination exercise, they

imagine maths set one as the learning context within their space. The candidate is cued up by verbal cues to imagine how their space might be changed by each of the learning context taking place within their space and how their activity might change.

The candidate then scores a comparative set of statements to the first baseline statement which identifies their scores in relation to *imagined cognitive self-operation* when participating in each learning context in their imagined space. By this method, the Footprints assessments obtain four comparative sets of data about each candidate; their *imagined cognitive self-operations* as baseline and then their *imagined cognitive self-operation* when participating in three specific learning contexts. This provides a measure of the learner's 'learner-environment state' in relation to their specific learning contexts.

### **Data collection**

Four cohorts of a total of 60 yr 10 students from three different schools undertook the Footprints assessments. Students undertook their baseline assessments within the context of an ICT session, and then a minimum of three further subject assessments including Maths, Science and English. Some 50% of students undertook additional assessments for further subjects beyond the required three.

### **Data Model**

The data model used in the study is composed of seven factors or elements involved in a model of cognition proposed by Walker 2009.

The Footprints assessment looks at seven factors which compose a student's cognition. The seven factors of data collected for each student are:

1. *Trust of my self- how much I trust my own ideas, qualities and opinions in this lesson*
2. *Trust of others- how much I trust other's ideas, qualities and opinions in this lesson*
3. *Pace- how much pace, risk and change do I like in this lesson*
4. *Disclosure- how willing am I share to share thoughts, ideas, opinions and questions in this lesson*
5. *Perspective- whether I see things from a detached or personal perspective in this lesson*
6. *Processing- whether I focus on making connections or following step by step in this lesson*
7. *Planning- whether I focus on the learning outcome or am open ended in this lesson*

In this study, the relationship between CAT score and factor 5 was assessed. Walker 2013 articulates this factor as proximity of the learner from the subject or knowledge. Walker (2009) claims that learning involves a dialogue between a detached and personal perspective. A remote position by the learner from the subject studied allows the learner to detach his personal feelings from the subject and may be termed detached. The bipolar opposite of the detached posture is the personal posture. In this, the learner chooses a close proximity to the subject. The learner's own personal responses are open and involved in the dialogue.

A previous study by Walker (2013) had indicated that higher set yr 10 students at one school in the UK exhibited a higher incidence of detached thinking postures than lower set students in the same school. In this study I was looking to strengthen this conclusion through data from an independent cohort of students from another school at which CAT scores for each student were available.

Perspective adopted by a student in relation to lesson was measured using the Footprints technology. Raw scores were converted to a 0-15 scale, with median score of 7.5. CAT score data for each student was obtained from tests completed in yr 7, at school entry.

## **Results**

A regression analysis was used to test for the relationship between CAT score and detached-personal perspective in students.  $F(1,227) = 9.08$ , significance  $F = 0.002868$ . The slope is significantly non-zero, indicating that there is a high probability of a relationship between detached-personal perspective and CAT score.

### **SUMMARY OUTPUT**

<i>Regression Statistics</i>	
Multiple R	0.19618
R Square	0.038487
Adjusted R Square	0.034251
Standard Error	10.38479
Observations	229

<b>ANOVA</b>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Sig F</i>
Regression	1	979.8841	979.8841	9.086139	0.002868
Residual	227	24480.55	107.8438		
Total	228	25460.44			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	95.85762	2.480482	38.64475	8.3E-102	90.96991	100.7453	90.96991	100.7453
10.5	-0.99903	0.331426	-3.01432	0.002868	-1.65209	-0.34596	-1.65209	-0.34596

## **Discussion**

These results indicate that one element of what we call cognitive ability in yr 10 students is related to the ability to adopt a detached perspective in regards to the subject the student is engaging with. The ability to adopt a detached perspective may relate to some aspects of executive function. Executive Function is a generalised construct that sits over a range of elements that relate to the effective handling of novel situations. These include events that involve planning or decision making; that involve error correction or troubleshooting; situations where responses are not well-rehearsed or contain novel sequences of actions; dangerous or technically difficult situations; situations that require the overcoming of a strong habitual response or resisting temptation.

Miyake and Friedman's model of executive function proposes that there are three aspects of executive functions: updating, inhibition, and shifting (Miyake et al. 2000; Miyake, Friedman 2012). Updating is defined as the continuous monitoring and quick addition or deletion of contents within one's working memory. Inhibition is one's capacity to supersede responses that are prepotent in a given situation. Shifting is one's cognitive flexibility to switch between different tasks or mental states. Studies on task switching have shown that processing speed is slowed when learners are required to switch from one task to another (Schneider, Logan 2005). This suggests that mental states required for mental activities may exist in a state of neural inertia or require a costly switch to be thrown to be activated (Derakshan 2010; Mayr, Keele 2001; Monsell 2003).

One framework for understanding this cost of shifting from one mental state to another is through consideration of the involvement of emotional state of executive control (Pessoa 2009). Hot

and cool emotional states have been proposed to describe differential cognitive inhibition via emotion. Hot emotional state is one when heightened emotion such as anxiety, or excitement or anger dominate. Hot states contrast with cool states in which emotional state is neutral. Studies have suggested that the task of cognitive shifting is more complex in a hot state than cool (Zelazo et al. 2010).

Such a framework may help explain the findings of this study. Adopting a detached posture when engaging in one's lessons may reduce the emotional work required for cognitive inhibition. A detached posture minimises the 'temperature' of one's own personal affective state and attitude toward the task and knowledge. This appears to reduce the task of inhibition in which one overcomes one's prepotent, or instinctive, response. It may also improve the ability to cognitively shift between different tasks and mental states. A detached perspective may allow for the learner to move more cleanly, carrying less mental baggage with them.

By contrast, a personal perspective is one which draws on, utilises and refers to one's own personal history, feelings and reactions to inform one's engagement with the subject. Adopting a personal perspective may activate one's prepotent response; it may also make the speed by which one can shift between tasks and mental states harder as one is carrying a greater burden of mental baggage. In such a state cognitive shifting involves doing more work, lifting more load.

Walker (2013) has previously claimed evidence that more academically successful students are able to *adapt* their perspective between the two poles of detached and personal perspective depending on the learning task in hand. He highlights evidence that higher set students adopt more detached perspective in Maths and Science lessons and more personal perspectives in English and Arts lessons. Lower set students, however, lack that cognitive adaptation.

Another framework for understanding this outcome is that of a thinking taxonomy such as Bloom (Green et al. 2002). This present study may provide supporting evidence that detached perspective is associated with more academically successful students because it is required for higher-order thinking such as conceptualisation, analysis and evaluation which are cognitive abilities required in all subjects.

## **Conclusions**

This study provides evidence that one measure of cognitive ability, CAT score, in yr 10 relates to the state of 'perspective' adopted by the learner in the learning environment. High CAT score students adopt more detached perspectives in their lessons whilst low performing students adopt more personal perspectives.

The outcome suggests that the Footprints construct of perspective may be related some constructs proposed within models of executive function. One construct is inhibition in which one overcomes one's prepotent, or instinctive, response. A detached perspective may also improve the ability to be cognitively flexible or shift between different tasks and mental states, a second construct of executive function.

Along with prior evidence that higher set students adapt their perspective for the learning task in hand, this study suggests that a detached perspective is required for higher-order thinking such as conceptualisation, analysis and evaluation which are cognitive abilities required in all subjects.

One of the limitations of this study is the small sample size. Larger sample sizes across different schools would improve the quality of this data.

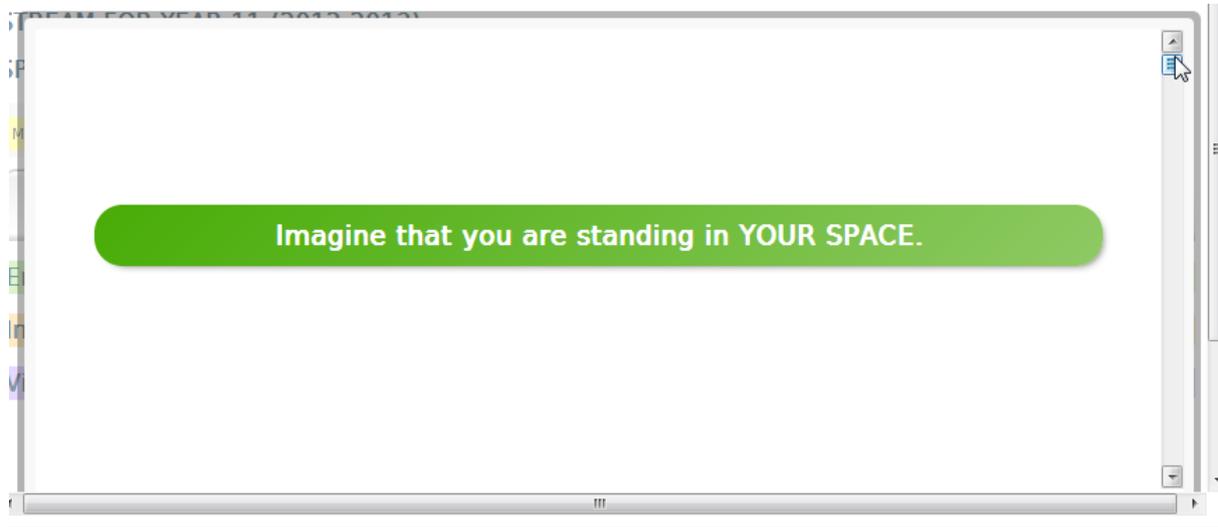
## **Disclosure**

The author acknowledges a conflict of interest through a commercial relationship with the manufacturers of the Footprints Assessment.

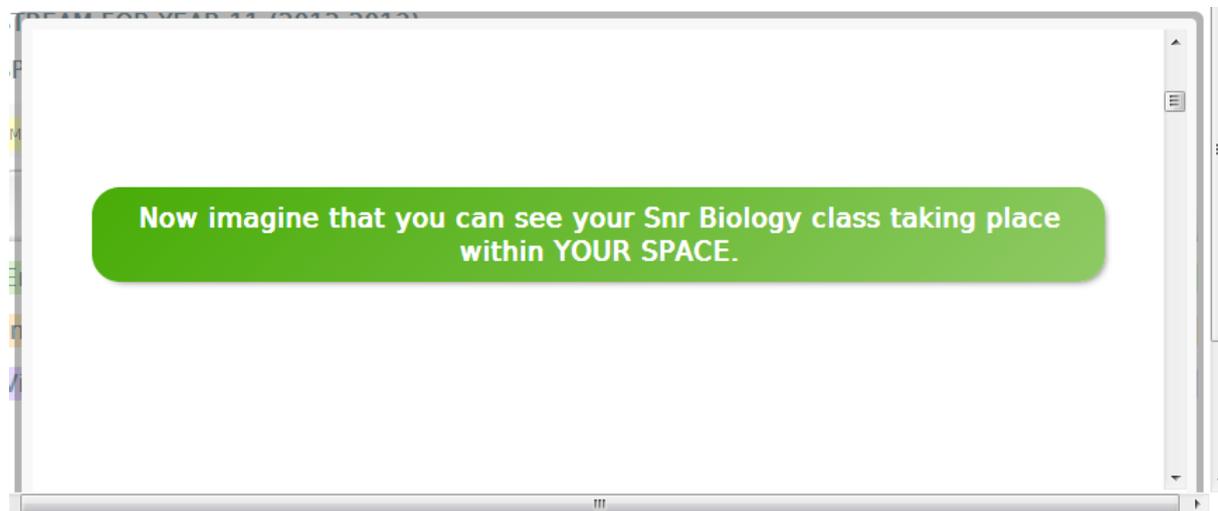
## Appendix

### **The Footprints Technology: Measuring imagined cognitive self-operation**

The Footprints assessment is a derivation of a projective test called the Personal Ecology Profile (Walker 2009). The psychological process involves triggering the imagination of the candidate to create a 'space' which they want to call their own through a series of neutral cues. The clean language of the assessment is important to allow the candidate to project their own, independent meaning and shape onto the cues.



Further verbal cues develop the imagined focus of the candidate on their previously created space, their imagined self-perception and self-operations



Further verbal cues then develop and explore the candidates' imagined self-perception and operation with the learning context present. A series of 28 statements then appear and are scored by the candidate. These relate to seven factors stated in the data model.

Has YOUR SPACE been changed by having the Snr Biology class in it?

Definitely not   No   Not really   Maybe   Yes   Definitely

[Empty box]

### Data Model

This study used Walker's conceptual model of Human Ecology Theory (Walker 2009) to define the cognitive self-operation. In the Footprints assessment four items score each factor. Each item is scored on a six point Likert scale as above. This results in twenty eight items measuring *cognitive self-operation* within a single learning environment.

The multiple learning contexts assessed therefore multiplies the number of times each item is scored.

A sample of three of the items is given below.

- *Do you need to know what is going to happen in YOUR SPACE when the keyword is with you?*
- *Does it help your learning in keyword when you can relate it to your own life?*
- *You need to make something in YOUR SPACE. Do you get lots of ideas popping into your head as you go along?*

## Centre for Human Ecology Theory, UK

The Centre for Human Ecology Theory was launched in 2013 and aims to develop insight into human behaviour using Walker's Human Ecology Theory as its major tool through its research projects. The Centre aims to bring together a community of practitioners from around the world committed to developing understanding of human behaviour and how to engender more humane, sustainable living through application of these ideas.

Walker's Human Ecology Theory was developed over a decade, from 2000-2010, by the author through his work initially carried out whilst doing postgraduate studies at Oxford University in the UK. Encompassing areas of human behaviour from personality theory, through to leadership, organisational dynamics, teaching and learning, coaching and market cycles, Walker's Human Ecology Theory claims to be a comprehensive human systems paradigm.

### **Resume of the researcher: Simon P Walker**

Simon Walker taught at Wycliffe Hall, Oxford University between 2002-2009. He worked as a consultant to the corporate world from 2002 and founded in 2004 The Leadership Community, an alumni of graduates from his Undefended Leader course that grew to around five hundred over the next five years.

In 2011 he announced a refocus on the area of education and schools, with a commitment to develop a curriculum for social, emotional and cognitive development. Walker co-authored with Jo Walker, also his wife, the Footprints schools programme, a version of the Human Ecology Approach for children. He became a Coach in Residence at Monkton Combe School in 2012.

Walker is the author of several ideas about human behaviour including a distinctive theory which he calls 'Human Ecology Theory', described in a monograph 'A Brief Introduction To The Theory of Human Ecology.'

From his Human Ecology Theory Walker has developed a number of other ideas in the areas of leadership, learning and coaching. He published the idea of 'undefended leadership' in a trilogy of books launched at the Oxford Literary Festival. His ideas have had an influence on writers in the area of Christian leadership (MODEM) school leadership (Seldon) and power in leadership (Preece).

Walker has also set out a basis for being 'undefended' upon Christian spirituality which he calls the Undefended Life and has taught the principles of Undefended Life in Africa, Norway, India and Australia. This has stimulated numerous responses from other commentators in the church.

Over the years, Walker has developed and commercialised several proprietary psychological technologies and instruments to analyse and develop people using a Human Ecology Approach. These including the Personal Ecology Profile, Leadership Signatures, Footprints Assessments and Coaching Signatures. He has collaborated with Meredith Belbin on several projects.

Prior to his wider adult education career, Walker was ordained as an Anglican vicar in 1997 and served his curacy in Abingdon, Oxfordshire. He has bachelor degrees in Biology and Theology from Oxford, an MPhil in Applied Theology from Oxford. He has just submitted his DProf by Public Works at Winchester University in 2014, a review of his contribution to the adult education between 1997-2014. He is an accredited member of The Association of Executive Coaching and Supervision.

References at <http://humanecology.webeden.co.uk/#/who-is-simon-p-Walker/4575814295>

## **Publication bibliography**

- Barber, Nigel (2005): Educational and ecological correlates of IQ: A cross-national investigation. In *Intelligence* 33 (3), pp. 273–284. DOI: 10.1016/j.intell.2005.01.001.
- Blair, Clancy; Granger, Douglas; Peters Razza, Rachel (2005): Cortisol reactivity is positively related to executive function in preschool children attending head start. In *Child Dev* 76 (3), pp. 554–567. DOI: 10.1111/j.1467-8624.2005.00863.x.
- Bull, R.; Scerif, G. (2001): Executive functioning as a predictor of children's mathematics ability: inhibition, switching, and working memory. In *Dev Neuropsychol* 19 (3), pp. 273–293. DOI: 10.1207/S15326942DN1903\_3.
- Burgess, Paul W.; Alderman, Nick; Forbes, Catrin; Costello, Angela; Coates, Laure M-A; Dawson, Deirdre R. et al. (2006): The case for the development and use of "ecologically valid" measures of executive function in experimental and clinical neuropsychology. In *J Int Neuropsychol Soc* 12 (2), pp. 194–209. DOI: 10.1017/S1355617706060310.
- Derakshan, Eysenck (2010): Emotional states, attention, and working memory. A special issue of cognition & emotion. Hove: Psychology Press (Cognition & emotion. Special Issue).
- Education Endowment Fund (2013): Teaching and Learning Toolkit. EEF and Sutton Trust. Available online at [http://educationendowmentfoundation.org.uk/uploads/toolkit/Teaching\\_and\\_Learning\\_Toolkit\\_\(Spring\\_2013\).pdf](http://educationendowmentfoundation.org.uk/uploads/toolkit/Teaching_and_Learning_Toolkit_(Spring_2013).pdf).
- Fernandez-Duque, Diego; Baird, Jodie A.; Posner, Michael I. (2000): Executive Attention and Metacognitive Regulation. In *Consciousness and Cognition* 9 (2), pp. 288–307. DOI: 10.1006/ccog.2000.0447..
- GL Assessments (2012): New Cognitive Abilities Test helps 'Intellectual Cinderellas' reach their STEM potential. UK. Available online at <http://www.gl-assessment.co.uk/research-and-articles/september-2012-new-cognitive-abilities-test-helps-%E2%80%98intellectual-cinderellas%E2%80%99>.
- Hattie, John (2009): Visible learning. A synthesis of over 800 meta-analyses relating to achievement. London, New York: Routledge.
- Hudlicka, Eva (2002): This time with feeling: Integrated model of trait and state effects on cognition and behavior. In *Applied Artificial Intelligence* 16 (7-8), pp. 611–641. DOI: 10.1080/08339510290030417.
- Lane, Richard D.; Nadel, Lynn; Ahern, Geoffrey (2000): Cognitive neuroscience of emotion. New York: Oxford University Press (Series in affective science).
- Mayr, Ulrich; Keele, Steven W. (2001): Changing internal constraints on action: The role of backward inhibition. In *Journal of Experimental Psychology: General*, Vol 134(3), Aug 2005, 343-367. 129 (1), pp. 4–26.
- Miyake, A.; Friedman, N. P.; Emerson, M. J.; Witzki, A. H.; Howerter, A.; Wager, T. D. (2000): The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: a latent variable analysis. In *Cogn Psychol* 41 (1), pp. 49–100. DOI: 10.1006/cogp.1999.0734.
- Miyake, Akira; Friedman, Naomi P. (2012): The Nature and Organization of Individual Differences in Executive Functions: Four General Conclusions. In *Curr Dir Psychol Sci* 21 (1), pp. 8–14. DOI: 10.1177/0963721411429458.

Monsell, Stephen (2003): Task switching. In *Trends in Cognitive Sciences* 7 (3), pp. 134–140. DOI: 10.1016/S1364-6613(03)00028-7.

Schneider, Darryl W.; Logan, Gordon D. (2005): Modeling Task Switching Without Switching Tasks: A Short-Term Priming Account of Explicitly Cued Performance. In *Journal of Experimental Psychology: General*, Vol 134(3), Aug 2005, 343-367. 134 (3), pp. 343–367. DOI: 10.1037/0096-3445.134.3.343.

Walker, Simon P. (2014 c.): Cognitive-Affective State (CAS), an Ecological Component of Executive Function, Explains Variance between CAT scores and GCSE Grade Predictions. Centre for Human Ecology Theory. UK. Available online at [www.humanecology.webeden.co.uk](http://www.humanecology.webeden.co.uk).

Walker, Simon, P. (2013): The Operation of the Imagined Self and its Role in Assessing Academic Ability. Centre for Human Ecology Theory. UK. Available online at <http://heeducation.webeden.co.uk/#/research/4574561474>, checked on 3/16/2014.

.