

# **The Relationship between Sequential Cognitive Processing and Emotional Compliance in Year 10 students**

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## **Abstract**

This study reviews data collected from cohorts of yr 10 students in the UK, across three different, independent learning environments, to identify potential correlations between learner-environment state and academic performance. The data was collected between December 2012 and December 2013 at four UK secondary schools. 403 Yr 10 students took part and more than 2,000 subject lesson assessments were made.

Learner-environment 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. This study provides evidence that the deployment of cognitive processing strategies in yr 10 students correlates with a particular social-emotional posture adopted by the learner toward the learning environment. Students who adopt a posture which is high trusting toward others' ideas and opinions and low trusting toward their own tend to deploy sequential, step-by-step cognitive processing strategies. By contrast, students who adopt a posture which is low trusting toward others' ideas and opinions but high trusting toward their own tend to deploy connective, lateral cognitive processing strategies.

This suggests that the development of cognitive processing is not purely an intrinsic mental task for the student but must be understood as an interaction that takes place between the student and their social learning environment. Moreover, current GCSE exam regimes which reward step-by-step processing over the connecting processing may well favour compliant students over self-directed students.

## **Introduction: theories of cognition and learner-environment state**

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. It emphasises that any individual learner will interact with and be influenced in his learning by the social and

cognitive environment he is learning in. The learner, therefore, cannot be studied in abstract or isolation; instead he must be looked at *in situ*, within the contexts in which he is learning.

### **Development of thinking strategies in adolescents**

A thinking strategy can be understood as the cognitive means by which a problem is approached and overcome. Sequencing vs lateral approaches to cognitive processing have been widely discussed and agreed as alternative and mutually important aspects of the task (Lindell 2011).

Walker (2009, 2013) in his Human Ecology Theory describes ‘sequencing’ processing strategies as step-by-step thinking. He argues these are demonstrated when the learner takes small, linear incremental steps between one point of understanding and the next. Heuristically, the learner is guided by the closeness of the next step rather than the overall emerging picture.

Walker calls lateral processing strategies ‘connective’ in that learners seek to join up individual or atomised points of understanding from diverse fields into a whole. Connective thinking strategies involve seeking to solve the problem as a whole first. The understanding of the whole, which is often by inference, guesswork or intuition, becomes heuristic in guiding the more linear, steps which are taken to work out the pathway or details by which the whole is composed.

In this study, my goal was to understand the relationship between the affective state associated with each of these cognitive processing strategies. My working hypothesis was that the use of either of these two processing strategies by a year 10 student would be *unrelated* to the student’s social/emotional posture. Sequencing and connecting are cognitive approaches which do not obviously, in themselves, require or preference an emotional state.

However, Human Ecology Theory regards learner posture 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, both social and emotional.

Human Ecology Theory, then, makes the non-obvious proposal that the deployment of a particular cognitive processing strategy may be influenced by the state of the learner – learning environment. In this study, the state of the learner within their learning environment is assessed in terms of two components: first, the trust of the learner toward themselves and second, the trust the learner has toward their surrounding learning environment.

Walker asserts that a student’s trust of them self relates to their individuated boundary from their surrounding learning environment (Walker Simon P. 2014) . A student who adopts a posture of high trust of them self but a low trust of others in that particular lesson has a self-defined mindset and is less likely to allow the ideas, questions and opinions of others or the teacher in the lesson to permeate their thinking. As such they typically trust their existing ideas, thoughts and opinions rather than questioning them.

By contrast, a student who adopts a posture of low trust of them self as a learner but high trust of others in that particular lesson, adopts a mindset that is more open and less fixed in its formation; it is more open to the ideas, questions and opinions of others or the teacher in the lesson to permeate them. As such, they typically question their own ideas, thoughts and opinions rather than trusting them.

These two distinct learning postures relate, then, to the student’s self concept in relation to that particular lesson or learning environment. Human Ecology Theory makes the non-obvious claim that these two postures (*high trust of self/low trust of others* vs *low trust of self/high trust of others*) may differentially influence the cognitive processing strategies that a student may adopt in the lesson.

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

The learner-environment state in this study is assessed using a technology called the Footprints Assessment. This assesses the distinctiveness from or continuity with the wider world the candidate has as a person. The appendix explains the technical mechanism which elicits such information. The candidate's scores for these question items compose the factor of 'trust of self'.

The Footprints assessment technology, developed on the basis of Human Ecology Theory, seeks to assess and model the learning strategies that a learner is deploying across their varied learning environments. The resulting data is understood then as the 'state that exists between the learner and their environment'.

The data provides the potential to understand the difference between what Walker calls 'optimal and sub-optimal learner-environment states'. Walker (2013) claims evidence that this technology can assess and model the relative cognitive adaptation of a learner to their learning environment. Additionally, this can be correlated with a proposed optimal cognitive strategy for the specific learning environment, resulting in an ability to rank the optimality of the learner's cognitive adaptation.

In this study, Walker reviews data collected from larger cohorts of yr 10 students in the UK, across a number of independent learning environments.

## **Method**

### **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.

### **Data collection**

Four cohorts of a total of 403 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*

Walker identifies these seven factors as forming two clusters:

Cluster one Learning posture (factors 1-4) which are social and emotional strategies:

1. *Trust of my self- how much I trust my own ideas, qualities and opinions in this lesson*
2. *Trust of other's- 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*

Cluster Two Thinking strategy (5-7), which are cognitive strategies:

1. *Perspective- whether I see things from a detached or personal perspective in this lesson*
2. *Processing- whether I focus on making connections or following step by step in this lesson*
3. *Planning- whether I focus on the learning outcome or am open ended in this lesson*

## Results

### **Trust of self/trust of others vs linear/connective processing**

A one-way ANOVA was used to test for the relationship of trust of self and trust of others against linear and connective processing in all three schools. The relationship between trust of others and trust of self differed significantly for linear and connective processing,  $F(1, 598) = 24.51$ ,  $p = .0000000958$ .

Summary						
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>		
Column 1	295	1582	5.362712	0.231938		
Column 2	305	1696	5.560656	0.247131		
ANOVA						
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	5.875634	1	5.875634	24.51637	9.59798E-07	3.857056
Within Groups	143.3177	598	0.239662			
Total	149.1933	599				

A regression analysis was then performed to confirm this relationship  $F(1,598) = 24.15$ , significance  $F = 0.00000115$ . The slope is significantly non-zero, indicating that there is probably a relationship between thinking and trust of self/trust of others.

### SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.197186
R Square	0.038882
Adjusted R Square	0.037272
Standard Error	0.490921
Observations	599

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	5.820647	5.820647	24.15175	1.15E-06
Residual	597	143.8789	0.241003		
Total	598	149.6995			

In summary, the data does not support the working hypothesis that the use of either of these two cognitive processing strategies by a year 10 student is unrelated to the student's state of trust of self/trust of others. Instead, the data supports the non-obvious proposal that the deployment of a particular cognitive processing strategy is strongly correlated to the learner-environment state: whether the learner's posture is of either high trust of self/low trust of others or whether it is a posture of low trust of self/high trust of others.

## Discussion

Houghton and Tipper (1996) review neurological and analytical evidence for the functions of sequential action and selective attention. They conclude that data from both behavioural and neural levels must be integrated in order to understand the inhibitory processes of cognition. The evidence from this study supports their conclusion. It provides evidence that the development of cognitive processing is not purely an intrinsic mental task of the student but must be understood as an interaction between a student and her class learning environment.

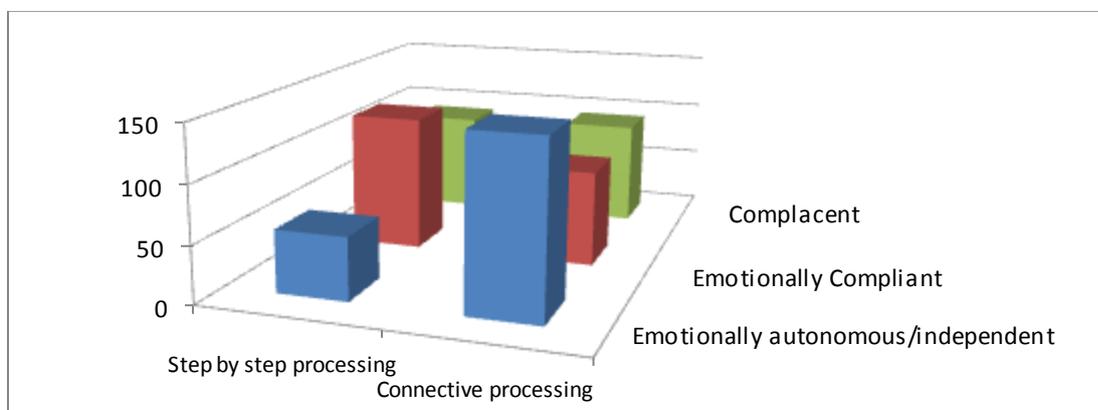
Gray et al. (2002) found neurological evidence that affective state can influence and direct cognitive function when performing a working memory task. Our data suggests that students preference a *specific* cognitive state in conjunction with the adopting an affective state of *either* emotional autonomy/independence or of emotional compliance.

Students who see themselves as high trusting of themselves but low trusting of others (emotional autonomy/independence) show a significantly higher focus on making connections in their thinking and seeing the big picture. This emotional and social independence appears to relate to a cognitive independence of mind and thought.

By contrast, a student who adopts a posture as a learner in that particular lesson which is low trusting of themselves but high trusting of others (emotional compliance) tends to deploy a more sequential, step-by-step processing strategy. Such students will exhibit more compliant, conscientious behaviours which appear to be related to an approach to thinking things in linear steps and focusing on the details rather than making connections and focusing on the big picture.

### The role of pedagogy

The development of cognitive processing strategies in secondary school students which encompass both sequencing and connecting cannot be divorced, then, from the pedagogic task of fostering the emotional environment of the class. Pedagogy which encourages compliance but discourages independence and self-direction will tend to produce linear thinking amongst its students. This suggests that the teacher's ability to tolerate and structure an environment to support non-compliant behaviours, in which students experiment with ideas which are non-orthodox or which defy norms or which are incorrect but interesting, will have a great bearing on student's cognitive development and range. Cultures which foster compliance in the classroom will fail to offer students the opportunities to develop connective and divergent thinking.



**Chart 1 Step-by-step and Connecting processing vs compliance or self-direction in students**

## **GCSEs and cognitive processing strategy**

Walker (2014) has provided evidence that low trust in oneself but high trust in others in a lesson correlates significantly with higher set in yr 10 students for non-arts subjects. In other words, for most subjects, this open, permeable learning posture is advantageous and more optimal for learning than a closed, less permeable posture.

This study refines that claim by highlighting that there appear to be specific cognitive processing strategies which emerge when students adopt such a learning posture within a class. It appears that academic success depends upon deploying a step-by-step cognitive processing strategy. Students who adopt, for social or emotional reasons, a more independent, self-directed posture toward the class environment maybe less likely to deploy the step-by-step, procedural processing that is required to be cognitively more successful in a UK yr 10 class in most subjects.

UK yr 10 students study for a GCSE exam which has been claimed by many to be an assessment of rote learning, process and technique more than conceptual understanding, independent thinking, creativity and application of ideas. Exam technique involves avoiding straying from the narrow and concrete answers required for the examiner to award the mark. This study provides interesting evidence that students who are compliant may be advantaged under such an exam regime, because they have an emotional preference to conform, fit in and submit to the rubric. Meanwhile students who are self-directed may be disadvantaged because their more instinctive connective thinking is not rewarded by such an exam regime.

It is possible to go further and suggest that such an exam regime may dis-incentivise students who think connectively because they are not rewarded academically. Those who choose not to become compliant may be reinforced in their posture of low trust of others because their contributions are not valued. Inadvertently, our exam system may be breeding two populations: one who assume authorities want and will reward compliance and linear thinking; the other who assume that authorities do not want and will penalise self-direction and connective thinking.

If it is the case that enfranchising compliant students who exhibit linear, step-by-step thinking serves the UK economy then this educational strategy will succeed. If, however, the UK economy requires self-directed and connective thinkers to be fully enfranchised beyond school in society then it is less likely to succeed in the long run, despite GCSE exam grades improving.

## **Conclusions**

This study provides evidence that the deployment of cognitive processing strategies in yr 10 students correlates with a particular social-emotional posture adopted by the learner toward the learning environment. Students who adopt a posture which is high trusting toward others' ideas and opinions and low trusting toward their own tend to deploy linear, step-by-step cognitive processing strategies. By contrast, students who adopt a posture which low trusting toward others' ideas and opinions but high trusting toward their own tend to deploy lateral, connective cognitive processing strategies.

This suggests that the development of cognitive processing is not purely an intrinsic mental task for the student but must be understood as an interaction that takes place between the student and their learning environment. Teaching which rewards compliance will tend to result in linear, risk-averse thinking. Teaching which rewards self-direction will tend to encourage connective thinking.

Moreover, current GCSE exam regimes which reward step-by-step processing over the connecting processing may well favour compliant students over self-directed students. It is possible that the current national assessment regime, by its formal disapproval of such thinking at school, may have an unintended consequence in disenfranchising connective-thinkers that this study shows that connective thinking coincides with a posture of low trust of others.

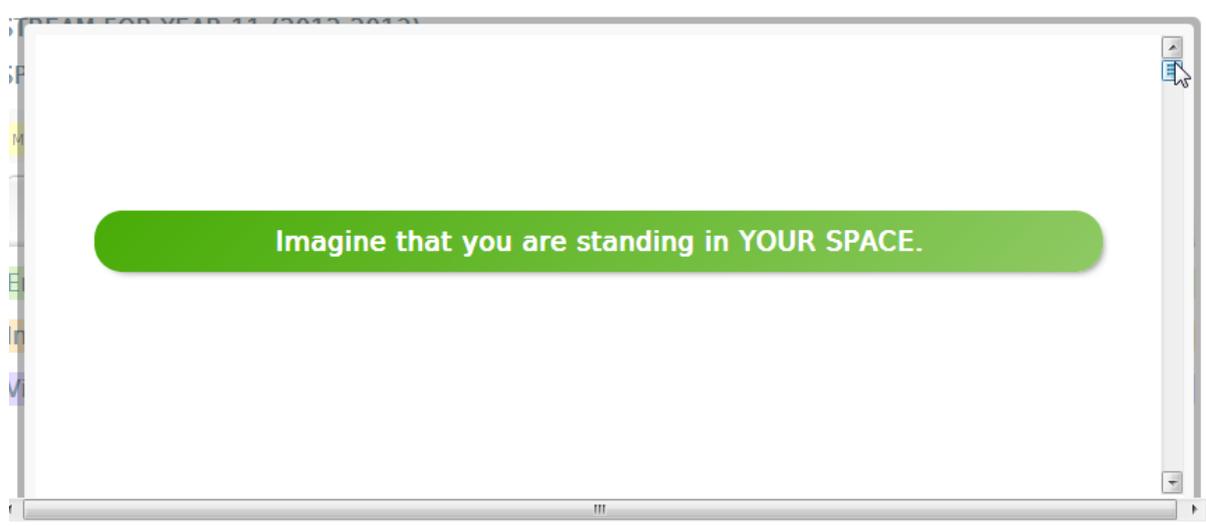
## **Disclosure**

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

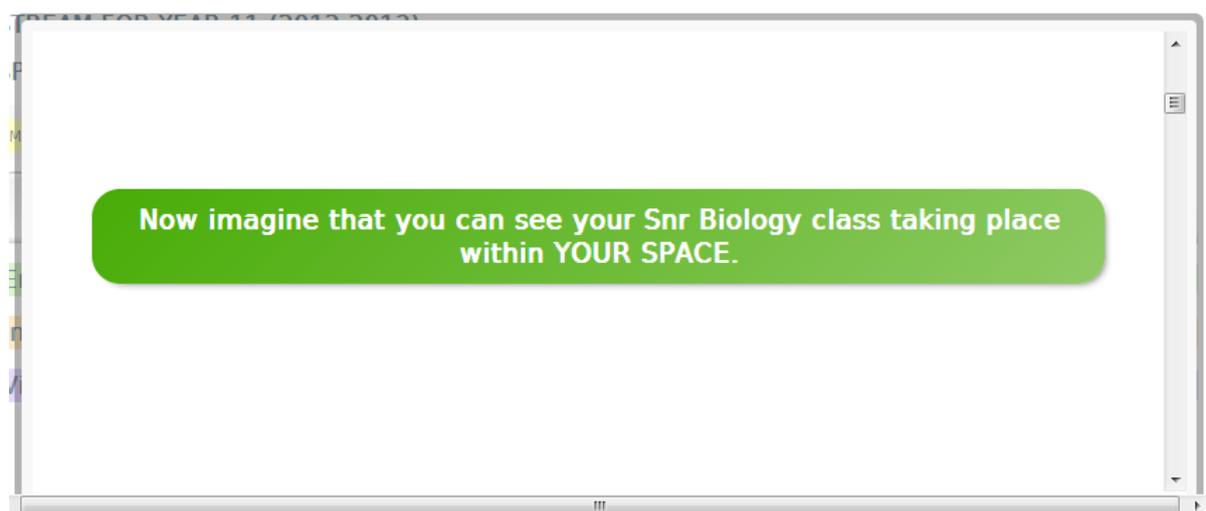
## Appendix

### **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

### 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?*

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**Centre for Human Ecology Theory, UK**  
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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>