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Action Identification and Meaning in Life in Chronic Pain

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Running title

Action Identification in Chronic Pain

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Abstract

This article explores the application of Action Identification Theory (AIT) to chronic pain. AIT holds that every action may be construed in several ways; each action has multiple identities. Construals at a higher, more abstract level confer greater meaning than lower level construals. When an action is interrupted a lower level, more concrete identity with reduced meaning is elicited. This study is a novel attempt to explore the relationship between action and meaning in chronic pain. We hypothesized that interference of activity by chronic pain 'down-regulates' the meaning ascribed to activity and consequently acts to reduce a person's overall sense of meaning in life. We describe the development of a measure of action identification in pain (AIP). In a second study the AIP was administered to 47 chronic pain patients who also completed the Meaningful Life Measure and measures of pain intensity, pain interference, depression, acceptance and optimism. As predicted high levels of action identification were positively correlated with meaning in life and high levels of interference were negatively correlated with meaning in life. Contrary to expectation interference and action identification were not associated. Further analyses revealed that the inclusion of depression, acceptance and optimism (all known correlates with meaning in life) eliminated these independent effects. The implications of action identification for chronic pain are discussed.

Perspective

This study is a novel attempt to explore the relationship between action and meaning in chronic pain. It reports the development of a measure of action identification for patients with chronic pain and small study testing the hypothesized relationship between action identification, pain interference and meaning in life.

Key words

Action identification; meaning in life; chronic pain; interference; self-regulation

Introduction

Patients with chronic pain may say things like, 'I don't think of tomorrow, I just take every day as it comes'. This suggests that chronic pain may prevent movement towards valued goals. Hyper-vigilance to pain symptoms, beliefs about pain determining one's future, fears about the uncontrollability of pain, or fears about certain activities aggravating pain can all lead to avoidance of, or withdrawal from, everyday valued activity [25]. As engagement in relationships and occupation diminishes, a person's sense of purpose, efficacy, self-philosophy and self-worth can be challenged. To our knowledge the relationship between a pain patients' sense of meaning in life and their appraisals of everyday actions has never been investigated. In this article we report an initial study examining the relationships between the interference attributed to pain, the meaning ascribed to everyday acts and a person's sense of meaning in life. We used a theory of the cognitive representation and organization of behaviour, Action Identification Theory, to inform the development of the study.

Action Identification Theory (AIT) states that any human act or behaviour can be described in several ways. For example, one person might describe an act as 'chopping vegetables', another might describe the same act as 'cooking dinner' and third person might describe it as 'trying a new recipe'. Each description holds a different level of meaning, ranging from automatic movement sequences to goal-oriented activities. The descriptions can be arranged hierarchically in relation to the personal qualities and values they exercise. This hierarchical arrangement has been formally conceptualized in theories of the organization of behaviour [e.g. control theory, 5] and the cognitive representation of action [e.g. action identification theory, AIT, 27] as illustrated in Figure 1.

INSERT Figure 1 about here

Low level descriptions or act identities are those which are more concrete, they concern the details and specifics of an act indicating how it is done, for example, the cyclist who is 'pushing peddles'[28]. High level act identities are those which are more abstract, reflecting general understanding of the act's effects and implications. These high level act identities are more likely to reflect the implementation of one's goals in accordance with personal values e.g. the cyclist who is 'getting exercise' in order to 'stay healthy'. High level identification affords greater means of achieving goals e.g., the cyclist may also swim or run in pursuit of the goal 'getting exercise'. AIT holds that three fundamental principles guide action identification: 1) action is maintained with respect to its focally attentive or *pre-potent* act identity; 2) there is a tendency for higher level act identities to become pre-potent as people search for meaning provided by the context in which they are acting; and 3) when something disrupts an action and it cannot be maintained in terms of its pre-potent act identity, a lower level act identity becomes pre-potent[27,28].

In this article we explore an implication of the third principle. We conjectured that the extent to which pain interferes with cognitive and behavioral acts will determine the degree to which a person adopts low level meaning. In essence we suggest that repeated interference by chronic pain of activity may down-regulate the level at which a person identifies individual actions and that this reduces the extent to which the person finds meaning in life. This has implications for the perception of meaning of actions and progress in attaining life goals and thus ability to maintain a continuous and valued sense of self[20].

Method

There were two phases in this research. In Study 1 we report the development of a measure of action identification suitable for use in a population with chronic pain – the Action Identification for Pain (AIP) scale. In Study 2 we use the AIP to test the implications of Action Identification Theory.

Study 1: The Construction of the Action Identification for Pain (AIP) Measure

Vallacher and Wenger developed the Behavior Identification Form [BIF, 29] to assess act-specific and individual differences in action identification level by distinguishing between low level and high level construal. In designing the BIF Vallacher and Wegner avoided high level act identities likely to be seen as unanticipated or unpleasant consequences of action and specified high level identities that were goal-like and fairly positive in nature. This was because the focus concerned the characteristic level at which people attempt to maintain rather than avoid action. To overcome the potential problem of respondents feeling obliged to select meaningful (thus high level) identities low level act identities were designed as valid descriptions of the act [29]. Thus high level identities reflect the implementation of one's goals, values and interests while low level identities are devoid of such meaning and self-defining potential. The BIF comprises 25 items in the form of stems describing a goal-oriented action at the mid-level of identification and two statements that identify the action at higher and lower levels accompany each stem. Respondents are asked to endorse a single identification statement that captures their view of the action. Examples of the BIF items are shown in Table 1. High level act identities are scored '1' and low level act identities are scored '0'. A total action

identification score is obtained by summing scores for all items. The BIF has satisfactory internal consistency ($\alpha = 0.84$) and test-retest reliability ($r = 0.96$) over 2 weeks[27].

INSERT Table 1 about here

In reviewing the BIF we concluded that many of the items lacked relevance for people with chronic pain. Many of the cited activities would be difficult to engage in and are unlikely to be age or gender relevant e.g. 'joining the army', 'climbing a tree'. In contrast everyday acts of living, e.g. 'Doing the ironing', may not necessarily be enjoyable to perform but people engage in them as they are necessary for their longer-term interests e.g. 'looking presentable', or for avoiding negative consequences e.g. 'looking scruffy'. These activities have the potential to be disrupted by pain, thus enabling investigation into the way in which people with chronic pain derive meaning in their day-to-day activities. We elected to construct the Action Identification for Pain (AIP) measure. To ensure maximum content validity we developed a pool of items informed by items drawn from published scales assessing disability and function.

An extensive literature review of existing measures of disability and functioning in chronic pain was conducted. Relevant measures and appropriate search terms were first identified in the 'Handbook of Pain Assessment' [3]. Independent searches using the title terms 'pain disability', 'pain functioning', 'measuring pain', 'pain inventory', 'pain index', 'problem inventory', 'sickness impact', 'pain measures', 'limitations profile' and 'measuring disability' were then run using two electronic databases in OVID: PsycINFO (1806 to January Week 1 2010) and MEDLINE (1950 to December Week 5 2009). To ensure generalizability of the items, measures that are typically only used in a population with a specific type of pain, or in a population of a specific age, gender or culture, were excluded. Those published in non-English

language journals were also excluded. Measures retained therefore were the Chronic Illness Problem Inventory [11], Groningen Activity Restriction Scale [13], Pain Disability Index [21], Sickness Impact Profile [2] and West Haven-Yale Multidimensional Pain Inventory [14]. Fifty-five mid-level item stems were written based on the items of these questionnaires. Item stems were statements that took the same format as the BIF e.g. 'joking with family members'. A high level act identity and a low level act identity were derived for each item stem (see Table 1 for sample items). These were developed in accordance with Vallacher and Wegner's hierarchy of perceived functional asymmetry, whereby a high level act identity is performed *by* performing a mid level identity, which is performed *by* performing a low level identity. For example, 'one sees if someone is home *by* pushing a doorbell, and one pushes a doorbell *by* moving a finger' [28]. Ambiguous items were removed and the item pool reduced to 40 items based on the consensus opinion of a sample of 25 graduate clinical psychology students who had been briefed with an information sheet explaining the essence of action identification theory and the definition of high and low level act identification.

Initial psychometric properties of the AIP

A questionnaire version of the AIP was developed using the same principles as the BIF. Each stem was paired with completions representing high and low level act identities. Both identities were placed below the stem, the upper one was labeled **a**, and the lower **b**. The spatial location of high and low act identities was counterbalanced across items: see Table 1. The measure is essentially a forced choice one as respondents are asked to select one of two act identities. The AIP was administered to 269 undergraduate students (165 females, age range 18 to 23). High level items were scored 1 and low level items 0; the mean total score = 25.09, *SD* =

5.90, range 6 to 40. There were no significant differences between males and females in the total score. For the majority of items, at least 20.0% of participants selected each identity. For the following items fewer people chose the low level act identity: 'doing the shopping' (9.7%), 'taking a holiday' (14.5%), 'laughing' (10.4%), 'taking care of business affairs' (6.3%), 'doing leisure time activities' (16.0%), 'listening to other people's problems' (7.4%), 'being affectionate' (11.9%), 'going out for entertainment' (12.3%), 'concentrating' (7.4%) and 'caring for myself' (12.3%). There was therefore a tendency to endorse items at the high level act identity. We however, chose to retain all items because the main hypothesis to be tested in the subsequent study predicted that pain patients might preferentially select low level identities in proportion to the level of interference. The full text, items and instructions of the AIP, is given in Appendix 1.

Following the precedent set in the construction of the BIF we computed Cronbach's α. It was satisfactory (α = 0.80) and similar to the level reported in the original BIF (0.84). Item-total correlations ranged from $r = 0.15$ to $r = 0.41$ and were not improved by removing any items. A principal component analysis revealed the existence of one primary factor (Eigen value = 4.83) and thirteen minor factors (Eigen values = 2.29 – 1.04). Some items did not load most strongly on the primary factor, cross loadings were evident and factors did not have many strong loadings. These results were interpreted as the AIP being a scale which reliably measures level of meaning construed in action, but that additional sources of identity level variance e.g. individual proficiency, familiarity with the act, action complexity, influence action identification level for individual items. As these numerous sources of identity level variance are important components of AIT, all items were retained to ensure that the scale was not

overly narrow. In a separate sample of 31 graduate students, test-retest reliability of the AIP was demonstrated over a period of 2 to 3 weeks ($r = 0.79$, $p < .001$), which is lower than the stability coefficient reported for the BIF (0.94).

Study 2: Action identification and Meaning in Life – An exploratory study

The main aim of this study was to test the hypothesised relationships between pain interference, action identification and meaning in life. Within the framework of AIT we conjectured that high levels of interference would be associated with an increased frequency of endorsing low-level action identities and a low level of overall meaning in life. In its strong form we conjectured that action identification might be a potential mediator between interference and meaning in life. The current literature indicates that depression and negative mood, acceptance, and optimism, are, to varying degrees, associated with meaning in life and pain interference. We therefore included measures of these constructs, first as a check on the validity of our measurement in the available sample, and second to explore potential unique contribution of action-identification.

A single group multiple measures design was used. We made two specific predictions: 1) that greater pain-related interference would be associated with an increased selection of low level act identities, and 2) that increased selection of low level act identities would be associated with a decrease in the sense of meaning in life. As there was no prior data on action identification and meaning in life in chronic pain we elected to use a small to medium value of $r = 0.35$, $\alpha = 0.05$ and power = 0.80 to estimate a required sample size of 60 for a two tailed test and 49 for one tailed test[7]. The primary analyses were the inter-correlations between pain

interference, action identification and meaning in life. Preliminary multiple regression models were explored. All analyses were computed using statistical software packages PASW Statistics version 18 [9] and SPSS version 20 [10]. Ethical approval was obtained from the UK National Health Service.

Participants

Participants were recruited over a five month period from UK National Health Service pain clinics based at 2 sites in a city in the north of England (population approximately 750,000). The inclusion criteria were non-malignant pain of at least 6 months duration, age 18 years and over and sufficient fluency in the English language to complete all measures. Of the 60 patients who agreed to take part, 13 either cancelled prior to interview or did not attend for their interview. Therefore, a total of 47 patients took part; 12 males and 35 females. No data was collected until the research interview (a condition of ethical approval) therefore information on patients attending the clinics who did not participate is not available.

Measures

Demographics

Basic demographic and clinical data were collected directly from participants: age, gender, pain duration, clinical diagnosis or cause of pain, site of pain and treatments or medications received for pain.

Brief Pain Inventory - short form (BPI-sf)

The BPI-sf [6] is a commonly used self-report measure of pain intensity and pain interference over the past 24 hours. For the intensity scale, the respondent is asked to rate their worst, least, average and current pain intensity on a 0 to 10 Likert scale, then scores for each

item are summed. For the interference scale, the respondent is asked to rate how pain has interfered with 7 different life domains (e.g. normal work, relations with other people, etc) on a 0 to 10 Likert scale and scores are summed. Satisfactory internal consistency for the intensity scale (α = 0.89 and 0.82 in 2 independent samples) and the interference scale (α = 0.95 and 0.93) has been demonstrated [12].

Meaningful Life Measure (MLM)

The MLM [19] is a brief but comprehensive scale with 23 items comprising 5 subscales: exciting life (items 1 – 5), accomplished life (items 6 – 10), principled life (items 11 – 15), purposeful life (items 16 – 19) and valued life (items 20 – 23). The respondent is asked to rate their level of agreement with each item on a 1 to 7 Likert scale (with the exception of items 1, 2, 3, 16 and 17 for which the anchors are specific to the item). An overall meaning in life score is obtained by summing across items. Satisfactory internal consistency for each subscale of the MLM (α range from 0.85 - 0.88) has been demonstrated [19]. We used the total score in all analyses.

Depression: Patient Health Questionnaire (PHQ-9)

The PHQ-9 requires the respondent to rate, on 0 to 3 Likert scales, how often in the last two weeks they have been bothered by each of 9 different symptoms of depression. The item total gives an overall index of severity of depression. The PHQ-9 has satisfactory internal consistency (alpha = 0.89 and 0.86) in two independent samples and test-retest reliability (r = 0.84) over 48 hours [15].

Chronic Pain Acceptance Questionnaire revised version (CPAQ-R)

The CPAQ-R [17] is a commonly used self-report measure of acceptance of pain as defined by pain willingness, i.e. a recognition that strategies aimed at avoiding pain are ineffective, and activity engagement, i.e. pursuit of activities in spite of pain. The respondent is asked to rate each item on a 0 to 6 Likert scale. A total acceptance score is obtained by summing scores for all items. Satisfactory internal consistency has been demonstrated for both the pain willingness ($\alpha = 0.78$) and activity engagement ($\alpha = 0.82$) subscales [17].

Life Orientation Test revised version (LOT-R)

The LOT-R [23] is a commonly used self-report measure of dispositional optimism which consists 3 items affirming optimism, 3 items disaffirming pessimism and 4 filler items. The respondent is asked to rate how much they agree with each item on a 0 to 4 Likert scale and a total score is obtained by summing scores for items. The LOT-R has satisfactory internal consistency ($\alpha = 0.78$) and test-re-test reliability ($r = 0.68$) over 4 months [23].

Action Identification for Pain (AIP)

Given the novelty of the measure and the nature of the data collection protocol we converted the AIP into a forced choice card-sort method to maximize engagement with the task. Each item from the questionnaire version of the AIP was presented individually on cards (12.7 x 7.6 cm) in the same format as the questionnaire. Participants were asked to place each card into one of two piles (A or B – marked on separate cards and placed left and right in front of the participant), depending on whether they preferred identity **a,** or identity **b** of each act. The instructions for administration of the card-sort were as follows:

"Any act can be identified in many ways. For example, if I asked you what you are doing now you might reply "answering questions", or "talking to you", or "helping you with

your research", or "sitting in a chair". There is any number of responses that you could give me. We are interested in your personal preference for how a number of different acts should be described. On the following cards (show the deck of cards) you will find several different acts. After each act will be two choices of different ways in which the act might be identified. For example (show practice card), the card might state the act "attending class" and the two identifications a, "sitting in a chair" and b, "learning new information". Your task is to choose the identification, a or b, that best describes the act for you. Simply place the cards into two piles depending on whether you prefer identification a or b. If you prefer identification a, put the card on pile A; if you prefer identification b, put the card on pile B. Of course, there are no right or wrong answers. People simply differ in their preferences for the different act descriptions, and we are interested in your personal preferences. Remember; choose the description that you personally believe is more appropriate in each pair."

Procedure

Participants were recruited at the pain clinic by a pain nurse specialist. Following ethical and consent procedures, an arrangement was made for the researcher to interview them either at the clinic or in their own homes. At the interview demographic and clinically relevant data was collected followed by administration of the BPI-sf and PHQ-9. These clinical measures were administered first so that perception of pain and mood were not influenced by subsequent questioning. Next, the AIP was administered followed by the MLM, CPAQ-R and LOT-R. Interviews lasted between 30 minutes and 110 minutes.

Results

One participant was a consistent outlier on several measures so their data was removed from all analyses. Where participants had missed items, these were substituted with their rounded average value for that measure. Where participants had not completed a measure, their data was excluded from subsequent correlation analyses. The limited sample size available for analysis means that the analyses are underpowered. We therefore chose to use a bootstrap algorithm (in SPSS) to estimate the confidence intervals for the inter-correlations and regression coefficients. The bootstrap estimates (5,000 resamples) were made on a subset of participants (n = 41) who provided complete datasets. We report the observed sample statistics in the text and Table 2 reports the bootstrap estimates of the bias corrected and accelerated (BCa) confidence intervals for the correlations. Where the significance of the observed correlations is not in agreement with the bootstrap 95%CIs this is noted and indicated by the insertion of **BCa* prior to the citation of the observed correlation. The bootstrapped confidence intervals for the regression coefficients are shown in Table 3.

INSERT Table 2 about here

Participants

We report data for 12 males (26.09%) and 34 females (73.91%). Mean age was 60.80 years (*SD* = 12.43). The majority of participants (58.70%, *n* = 27) experienced pain at multiple sites over their body. 9 participants (19.57%) said their primary site of pain was their back, 6 participants (13.04%) said legs and only 1 participant (2.17%) reported each of the following: arms, feet, abdomen and shoulder. The most common diagnosis (47.83%, *n* = 22) was spinal damage of some sort (e.g. degenerative condition, nerve damage, fall, etc). 12 participants (26.09%) reported a specific condition (e.g. amputation, fracture, hereditary neuropathy,

multiple sclerosis, etc) and 10 participants (21.74%) reported a type of arthritis. Only 2 participants (4.35%) said that their pain was unexplained. 35 participants (76.09%) were taking pain medication (e.g. tablets, patches, injections) and 10 participants (21.74%) were combining pain medication with physiotherapy or other treatment e.g., spinal cord stimulation or TENS. One participant (2.17%) was receiving no treatment.

Pain

Mean pain duration was 14.59 years (*SD* = 10.64), mean pain intensity (BPI-sf) was 21.44 (*SD* = 6.26) and mean pain interference (BPI-sf) was 38.02 (*SD* = 15.46). Intensity was significantly positively correlated with duration ($r = 0.31$, $P < .05$) and pain interference ($r = 0.40$, $P < .01$).

Meaning in life

The mean MLM score was 115.64 (*SD* = 22.40). As hypothesized, meaning in life was negatively correlated with pain interference ($r = -0.39$, $P < .01$). The greater the level of meaning a person perceived in life, the less pain interference they experienced. Meaning in life was also significantly positively correlated with age ($r = 0.37$, $P < .05$). We conducted a check on the validity of the MLM in the current sample by correlating it with previously established criteria. Meaning in life was positively correlated with acceptance ($r = 0.46$, $P < .01$) and optimism ($r = 0.54$, $P < .01$) and negatively correlated with depression ($r = -0.53$, $P < .01$).

Depression, acceptance and optimism

The mean PHQ-9 score was 10.41 (*SD* = 6.63) which falls within the 'moderate depression' category. Mean acceptance (CPAQ-R) was 57.20 (*SD* = 14.66) and mean optimism (LOT-R) was 13.12 (*SD* = 4.46). As might be expected, some inter-correlations between the

psychological variables and the pain variables were observed. In sum, depression was negatively correlated with age (r = -0.37 P < .05) and acceptance (*BCa r = -0.35, P < .05) and positively correlated with pain intensity (*BCa r = 0.35, P < .05) and pain interference (r = 0.73, P < .01). Acceptance was negatively related to pain interference (r = -0.37, P < .05). Optimism was also negatively related to pain interference (r = -0.33 P < .05).

Action identification

Satisfactory internal consistency of the AIP was replicated in the current sample (α = 0.76). Mean action identification was 26.35 (SD = 5.54) which was not significantly different from that of the undergraduate sample used in the psychometric evaluation of the AIP ($t_{(313)}$ = -1.35, P = .178). As hypothesized, action identification was positively correlated with meaning in life (r = 0.31, P < .05). People who identified actions at a higher level experienced a greater sense of meaning in life. Action identification was also positively correlated with optimism (r = 0.37, P < .05). Contrary to our prediction action identification was not significantly correlated with pain interference.

Exploratory multiple regression analyses

In accordance with the research hypothesis, significant relationships between pain interference, action identification and meaning in life were explored further using preliminary multiple regression models. Meaning in life was the dependent variable. Checks for multicollinearity and homoscedasticity were met, and errors were normally distributed. Results are displayed in Table 3.

Insert Table 3 about here

In model 1 pain interference and action identification were simultaneously entered and accounted for 23.7% of variance in meaning in life score. Both pain interference (β = -0.38) and action identification (β = 0.30) contributed significantly to variance in meaning in life. However, when the known correlates of meaning in life (depression, acceptance and optimism) were entered into model 2, pain interference and action identification did not significantly contribute to variance in meaning in life. Statistically depression was the biggest significant predictor (β = -0.41), followed by optimism (β = 0.39), then acceptance (β = 0.28). The model accounted for 51.6% of variance in meaning in life. The BCa estimates of the 95%CI of B in both models indicate that these findings are robust.

Discussion

The purpose of the current research was to explore the implications of Action Identification Theory for understanding the relationship between action, interference and meaning in chronic pain patients. The explicit conjecture derived from the theory was that ongoing interference to cognitive and behavioral acts attributable to chronic pain 'down-regulates' the level at which a person identifies action and thus reduces the sense of meaning in life. We found support for two of the three expected relationships. First, pain interference negatively correlated with meaning in life, as was expected based on existing literature. For example, Breivik et al. [4] investigated the impact of chronic pain in 15 European countries and Israel. They found that chronic pain of moderate to severe intensity seriously affected perceived ability to fulfill social and occupational activities [4]. The ability to fulfill such worthwhile activities is necessary to attain life goals thus is a pre-requisite of a valued, meaningful life [19]. Second, action identification, as measured by the AIP, positively correlated with meaning in life.

Again this was expected based on the literature on AIT. Higher levels of action identification infer more meaning thus hold greater self-defining potential which helps to maintain a continuous and valuable sense of self [28]. Both pain interference and action identification contributed significant variance in meaning in life.

Contrary to prediction we found no relationship between pain interference and the level of action identification and evidence for the hypothesized mechanism by which pain interference might 'down-regulate' a person's sense of meaning in life was not forthcoming. Prior to dismissing this hypothesis other factors might be considered. First, it may be that the precision of measurement of the constructs is not sufficiently refined. In particular we note that interference was assessed with a relatively short scale that requires participants to endorse general statements. In contrast the measurement of action identification required endorsement of more specific items. There is evidence that low mood (depression) is associated with a bias to endorsing the extremes of generalized statements [24,1] and the possibility arises that the measure of interference is biased by current mood. Conversely the items in the AIP might not be relevant to all participants and this might bias the assessment of action identification. Improved measurement of both variables might be obtained if participants reported on both the personal relevance of the actions and the degree of interference. Another possibility for the lack of correlation between pain interference and action identification concerns the implications of habitual high or habitual low level identification. A review of the current literature [9] concluded that low level action identification may be necessary for goal initiation by focusing on aspects of feasibility, though progress towards goals is hindered if low level identification continues, which probably results in eventual withdrawal from activity. While high level

identification is necessary for progress for existing goals, without the necessary focus on feasibility (i.e. low level identification), particularly as pain makes action more difficult, goal initiation is compromised thus withdrawal from activity probably occurs in this instance also. Thus habitually identifying action at a too low or too high level and not having capacity to flexibly adapt to an appropriate level of identification may be detrimental to functioning and it may be perceived as greater interference. Future research might consider goal initiation as well as goal progress in relation to high level identification, low level identification, action identification flexibility and subsequent implications for functioning (i.e. level of pain interference perceived) and meaning. This may help to clarify how interference relates to action identification.

We also obtained measurements of known correlates of meaning in life and their inclusion in a multiple regression model effectively abolished the statistical relationship between interference, action identification and meaning in life. The pattern of correlations indicates that depression, acceptance and optimism are primarily and strongly related to interference and meaning in life rather than to action identification, although optimism was correlated with action identification. Despite the small sample size and inability to infer causality, it seems reasonable to suggest that pain interference and low level action identification compromised sense of meaning in life, but that these mechanisms operate at a level subsumed by the more global constructs depression, acceptance and optimism.

Depression, acceptance and optimism contributed significantly to variance in meaning in life. This is consistent with the growing body of evidence in support of acceptance and commitment based interventions [16]. Acceptance and Commitment Therapy (ACT) with

chronic pain patients aims to help patients see that elimination or control of pain are unworkable strategies (which result in isolation from work and social activities) and replace this with a willingness to experience thoughts and feelings associated with pain. In other words, ACT aims to increase psychological flexibility. ACT also focuses on behavioral changes necessary to create a more meaningful life via engagement in patterns of committed action that are consistent with personal values [22]. Optimism training may be another intervention with the potential to increase meaning in life in chronic pain [18].

Limitations

The AIP was developed to test the research hypothesis. Satisfactory internal consistency and test-retest reliability was demonstrated that were comparable psychometric properties to the established BIF. Following the precedent set by the developers of the BIF [27] we computed an internal consistency estimate. Conceptually this assumes that all the items are representative of a trait-like entity. We acknowledge that that assumption may be debatable in this context. The content validity was enhanced in the AIP by virtue of the items being derived following a systematic review of existing measures of disability and functioning in chronic pain. Never the less development is warranted on larger samples of patients with chronic pain and further development is required to establish other aspects of validity (construct and predictive). Against our implicit expectation the mean AIP scores for the clinical and student samples were not different. It is not clear why this might be so and given the multiple sources of difference between the groups it is possible that a third variable (age or depression) influenced action identification. As we obtained no other measures from the samples in Study 1 we cannot investigate this further. Alternatively, developments in AIT[26] point to an 'emergence process'

which suggests that low level identification may not become habitual, instead interruption results in the adoption of an alternative high level identity (search for meaning, AIT principle 2).

We acknowledge that the sample size in Study 2 is smaller than desirable and this has implications for generalization of the results beyond the immediate sample. We are however partly reassured by the results from the bootstrap analysis which suggest that observed results are reasonably robust for the population from which we sampled. The sample was drawn from a generic population of chronic pain patients with long histories of pain and multiple contacts with health services. The sample was therefore heterogeneous with regard to diagnosis but with prolonged experience of pain. It is probable that the sample is also psychologically heterogeneous and this heterogeneity may be independent of diagnostic grouping. For example, classification on the basis of psychosocial variables using the Multidimensional Pain Inventory has repeated produced a classification irrespective of medical diagnosis [8]. Clearly further work would need to address the issue of heterogeneity. Further work is necessary with larger samples to reliably determine whether chronic pain interference and action identification predict meaning in life in chronic pain and whether AIT has clinical utility. Normative data for the AIP are also required.

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Figure Legend

Figure 1

This figure provides a schematic illustration of the theoretical frameworks used in the development of the study. The levels of Carver and Scheier's self-regulatory control theory are shown on the left. Exemplars of each level are provided in the centre, illustrating the interconnected hierarchical arrangements between action and meaning. The right side schematizes action identification theory and indicates the dynamic change in identification between low level concrete and high level more abstract descriptions of an action. See text for more details. In developing a measure of action identification suitable for pain patients we nominated program level activities such as cooking dinner and generated two descriptions of the activity: a low level descriptor corresponding to the sequences level of self-regulatory control theory, and a higher level description of a program that was not completely abstract.

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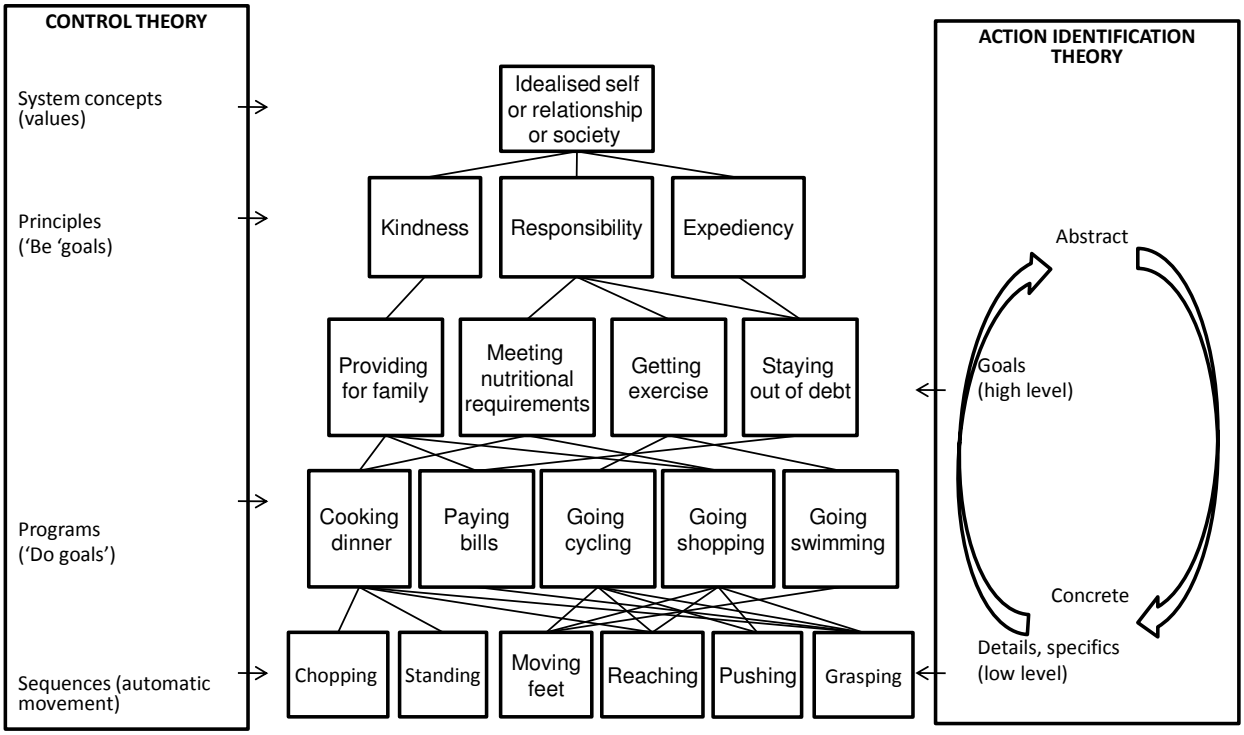
CONTROL THEORY
System concepts (values)
Principles ('Be 'goals)
Programs ('Do goals')
Sequences (automatic movement)
Idealised self or relationship or society
Kindness
Responsibility
Expediency
Providing for family
Meeting nutritional requirements
Getting exercise
Staying out of debt
Cooking dinner
Paying bills
Going cycling
Going shopping
Going swimming
Chopping
Standing
Moving feet
Reaching
Pushing
Grasping
ACTION IDENTIFICATION THEORY
Abstract
Goals (high level)
Concrete
Details, specifics (low level)

Table 1

Sample items of the Behaviour Identification Form (BIF) and the Action Identification in Pain (AIP) measure (* = high level act identity).

BIF	AIP
6. Chopping down a tree	1. Cleaning the house
a. Wielding an axe	a. Vacuuming the floor
b. Getting firewood*	b. Showing one's concern for cleanliness*
10. Paying the rent	21. Dressing myself
a. Maintaining a place to live*	a. Putting on clothes
b. Writing a cheque	b. Getting ready to go out*
25. Pushing a doorbell	25. Walking up and down hills
a. Moving a finger	a. Taking exercise*
b. Seeing if someone's home*	b. Putting one foot in front of the other

Table 2 Bootstrap (BCa) 95% confidence intervals for the inter-correlations, number of sample = 5,000; N= 41. Values in bold are significant.

	BCa 95%CI	Pain Duration	Pain Intensity	Pain Interference	Meaning in Life	Depression	Acceptance	Optimism	Action Identification
Age	*lower*	-.369	-.443	-.491	***.089***	***-.540***	-.131	-.084	-.319
	upper	.216	.179	.040	***.518***	***-.087***	.314	.575	.233
Pain duration	*lower*		***.086***	-.011	-.424	-.086	-.464	-.346	-.441
	upper		***.624***	.539	.223	.430	.156	.350	.212
Pain Intensity	*lower*			***.057***	-.290	-.056	-.220	***-.459***	-.130
	upper			***.594***	.324	.567	.373	***-.001***	.329
Pain Interference	*lower*				***-.557***	***.528***	***-.619***	***-.545***	-.349
	upper				***-.118***	***.824***	***-.082***	***-.059***	.284
Meaning in Life	*lower*					***-.707***	***.137***	***.209***	***.059***
	upper					***-.299***	***.726***	***.783***	***.560***
Depression	*lower*						-.670	***-.503***	-.457
	upper						.095	***-.047***	.178
Acceptance	*lower*							-.111	-.240
	upper							.557	.410
Optimism	*lower*								***.049***
	upper								***.610***

Table 3

Summary of standard multiple regression models with the meaning in life measure (MLM) as the dependent variable. In *Model 1* pain interference and action identification were entered as the sole predictors. In *Model 2* depression, optimism and acceptance were also added. Bootstrap values (BCa) for the standard errors of B are given and as are the values and β and its associated p value.

* Significant at $P < 0.05$; ** Significant at $P < 0.01$.

	B	BCa 95% Confidence Interval		β	P
		Lower Bound	Upper Bound		
Model 1					
$F_{(2, 42)} = 6.53$, $P < .01$ $R^2 = .24$					
Adjusted $R^2 = .20$					
Constant	104.60				
Pain interference	-.56	-0.91	-0.24	-0.38	.004
Action identification	1.21	0.27	2.24	0.30	.008
Model 2					
$F_{(5, 35)} = 7.48$, $P < .001$ $R^2 = .52$					
Adjusted $R^2 = .45$					
Constant	60.49				
Pain interference	.25	-0.15	0.81	0.17	*ns*
Action identification	.41	-0.59	-1.63	0.10	*ns*
Depression	-1.47	-3.03	-0.64	-0.41	.022
Acceptance	.43	0.01	1.03	0.28	.035
Optimism	1.91	0.33	3.29	0.39	.026