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Towards Empathy: A Human-Centred Analysis of Rationality, Ethics and Praxis in Systems Development

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Abstract: Functionalism has long been the dominant paradigm in systems development practice. However, functionalism promotes an innate and immutable instrumental rationality that is indifferent to human values, rights, society, culture and international stability. It, in essence, lacks empathy. Although alternative paradigms have been promoted for decades in the systems development literature to help address this deficit, functionalism remains dominant. This paper reiterates the call for a fundamental paradigm shift away from myopic functionalism and towards a more empathic and human-centred philosophy. It argues that the human-centred tradition offers a philosophically compatible and mature approach that can be practically harnessed for promoting empathy in systems development. The paper investigates the potential of systems development to become truly human-centred using data originally collected as part of a multi-method critical-interpretive study of privacy in information systems development. Multiple methods are used for the data analysis presented, including principal components analysis, hierarchical clustering, Q methodology, and descriptive statistics. The multi-method analysis demonstrates a marked discreetness exists between human-centred sentiments and instrumentally rational ones in systems development praxis. The paper concludes by presenting recommendations on how human-centred values can be practically fostered and engaged to enable greater empathy in contemporary system development and strengthen international stability.

Keywords: Hierarchical clustering, empathy, ethics, human-centred, principal components analysis, Q methodology, rationality, systems development.

1. Introduction

Functionalism has long been the dominant paradigm for systems development (Stapleton, 2006). Cognate approaches such as "scientific management" – or "Taylorism" (cf. Taylor, 1911) – venerate raw efficiency, see nothing of value in the human aspect, and exemplify the "man as machine" myth that has long pervaded systems development (Hirschheim and Newman, 1991). However, such Tayloristic drives for efficiency can lead to ineffectiveness, skimping, and the unethical treatment of humans (Mintzberg, 1989). Consequently, critical studies in systems development have sought to reveal, critique, and explain how the development and use of systems in the pursuit of efficiency, rationalisation, and progress had wider – and potentially detrimental – implications for some stakeholders and society as a whole (Cecez-Kecmanovic et al., 2008).

Although functionalism is dominant, there are other paradigms or "schools of thought" that systems development can follow (Iivari, 1991). These different paradigms essentially hold different philosophical assumptions and goals for systems development. Some of these goals are ostensibly functionalist in nature, whilst others are more social or human-centred. Some engender control, whilst others are more emancipatory and seek to empower people. Hirschheim and Klein (1989), for instance, presented a four-paradigm model of systems development: functionalism, social relativist, radical structuralist, and neohumanism. The functionalist paradigm was most divergent to the neohumanist paradigm, as they adopted diametric epistemological and ontological perspectives. Whilst functionalism advocated notions such as objective and efficient control, a key value of neohumanism was the contrasting ideal of human emancipation, which sought to harness human potential free from external domineering forces (Hirschheim and Klein, 1994). This paradigm of systems development can be seen, at least to some degree, in some systems development approaches. For instance, the socio-technical approach – the "antithesis of Taylorism" (Avison and Fitzgerald, 1995, p.361) – values human factors and technological issues equally (Mumford, 2000). Another example is human-centred design, which places human needs, purpose, skill, creativity and potential at the heart of human organisations and technical systems engineering (Gill, 1996). By using these human-centred approaches, technology can be harnessed in an effective manner, whilst respecting and empowering individual people by being empathic to their needs and values.

It is also important to recognise the "symbiosis" that exists between technology and contemporary society. Technological development in areas such as systems engineering plays a key role in determining the trajectory and, indeed, shaping the values of contemporary society at both national and international levels. The decisions made by individual systems engineers in professional praxis are heavily influenced by personal values (Kumar and Bjorn-Andersen, 1990), including decisions that hold broader ethical ramifications (Kreie and Cronan, 2000). The personal values of systems engineers are consequently embedded in system designs and proliferate through system implementation artefacts and dissemination choices (Brey, 2000, Friedman, 1996). These choices may be influenced or constrained by the culture in which the engineers work but they are, nevertheless, individual choices that affect other people's lives (Conlon and Zandvoort, 2011). The decisions made by a few individuals therefore hold the potential to affect broad collectives of people who are impacted, on many levels, by technological systems development. In short, human decisions impact technological development, technological development shapes societal values, and societal values impact human decisions in an iterative and on-going fashion. Given the symbiotic nature of technology/values/decisions it is imperative to understand the ethical behaviour and values of systems engineers, and the modes of rationality that they employ individually and collectively, in making ethically pertinent decisions during the systems development process that can impact other people, cultures, value systems and beliefs.

The human-centred tradition recognises the potential that can be harnessed by having empathy for people during systems development engineering. Empathy is a set of psychological processes that makes a person's feelings more congruent with another's situation than their own (Hoffman, 2001). The level of empathy realised depends on the paradigm the systems development process, and also on the rationality, ethicality and behaviour of the systems development engineers in professional praxis. The two (process and people) are inseparable, and contribute to a culture (or lack thereof) of human-centredness and empathy in systems development. As it relates to the recognition and accommodation of culturally specific needs and values, empathy is a major contributing factor towards international stability. It is therefore vital that the level of empathy manifest in contemporary systems development is critically examined to understand the implications for fostering international stability, and how this may be improved in the future.

2. Objectives and Research Questions

The objectives of this paper are to investigate whether human-centred empathy is manifest in systems development, both in the process and people involved, and how it might be fostered for international stability.

The research questions are:

RQ1. *Does the systems development process exhibit empathy?*

RQ2. *Do systems development engineers exhibit empathy?*

RQ3. *How can empathy be fostered in systems development in order to support international stability?*

3. Empathy in Systems Development: A Literature Review

3.1. Antecedents of Empathy in Systems Development

Hoffman (2001, p.3) noted that "empathy is the spark of human concern for others, the glue that makes social life possible." This spark of human concern, that is, empathy, has broad and deep antecedents in the systems engineering literature, where it is recognised that the overall mission of engineering is to contribute to human welfare (Colby and Sullivan, 2008). How does empathy feature in systems analysis, design and development thinking?

System engineering methodologies have been predominantly focussed upon deriving a technical solution, rather than a system which is a symbiosis of human activity systems and technological capability (Gill, 1996; Ovaska and Stapleton, 2010). Techno-centrism de-emphasises the human aspects of a symbiotic human-machine system, choosing instead to focus upon technology as an end in and of itself. Techno-centrism may foster a condition devoid of empathy for the human and other natural communities who must make sense of and adapt to the technology-in-use. This problem has been well documented and is not new to literature. Twenty years ago the rationality which underpinned software systems development was described as mainly mechanistic. It was recognised that methods were needed which drew upon metaphors centred upon humans in community working out life together. Candidate metaphors included *family, journey* and *society* (Kendall and Kendall, 1993).

In order to be able to appreciate the use-context, the system engineer needs practical experience of the world of the user. Without this it is difficult to understand the interpretations that users have of their world, and therefore the subjective meanings and interpretations that they have of systems development as it affects them. Furthermore, there remains a disconnect between the language of the analyst and the language of the user, which can be replete with ambiguities and complexity, especially in larger systems projects (Stapleton, 2001). Without this software specifications and the software system itself may be difficult to understand and may make little sense (Bickerton and Siddiqi, 1993; Stapleton 2003; Murphy 2008). Observation, story-telling and other forms of engagement in the life-world of the user enables engineers to appreciate the world in which the user must live out their working lives in relationship with technology, a relationship which should, ideally, be symbiotic. It also helps the analysts to *appreciate* the ways in which human knowledge, as opposed to codifiable machine intelligence, is used in everyday life (Murphy and Stapleton, 2005; Stapleton et al. 2005; Cooley, 1987). *Appreciative systems*, that is, systems design praxis in which people come to understand the context in which human judgements must be made and enacted was set out by Vickers who drew upon years of experience at senior management level to characterise how effective decision making systems worked (Vickers, 1973). His ideas formed the basis for Soft Systems Methodologies developed many years later and which draw together various aspects of the systems design and development task into a methodology which emphasises effective intersubjective and sensemaking processes. These help develop empathy between the various players in the systems design and development activity (Checkland, 1999). This approach helps build a dynamically stable socio-technical system which is replete with effective feedback processes and communications systems which ensure that the system remains efficacious and efficient. Mumford also recognised the importance of creating dynamically stable socio-technical systems rather than functionally effective technical systems. Her ETHICS methodology achieved this through dynamic feedback processes designed as a symbiotic human-machine system which ensured systems analysis and design resulted in an organisational learning process. This process emphasised learning together and appreciating each other's particular roles and tasks within a joint-design project which combined technical and social systems design into a single solution (Mumford, 2003).

Some took these ideas further and questioned the very idea of system and method. For example, Ciborra saw the problem as rooted in the very idea of methodology which he believed to be inadequate for information technology deployment in organisations. He became highly critical of the way in which systems theory was operationalised during the development of technologies and the way this process shaped users' lives. For him this was a manifestation of a crisis in science itself, a crisis which was phenomenological in nature. Science requires certain phenomenological "distortions" in which an ideal (he calls it "geometric") universe is used to describe and explain the reality of everyday life as if it is easily clarified and predictable. In fact the context within which technologies like computer systems are used is "murky" and "vague" (Ciborra, 2004). Human activity and the information and knowledge processing that accompanies it operates in the imperfect and unpredictable contours of life, not in some abstract, idealised world of scientific law and procedure. The underlying assumptions of science detach us from everyday existence and impose the notion of an ideal to which users should conform in their use of technology. This is a kind of myth, which may not create enough space for the user to tell his or her story, or to make sense of a new technology in the bricolage of their lives. There is little room for empathy here, and Ciborra contended that we need to think in new ways about technology design and development. For example, he described technology as a *guest* in a new community. The community is the *host* organisation into which the technology is to be introduced as a *stranger*. This simple shift of language has profound consequences for the way we thing about systems analysis and design. Instead of functional design, we think of culturally located and more ancient ideas of *hospitality* and *care*. We are also drawn into the particular context in which hospitality is offered, to the technology as a guest (or stranger) and how empathy and understanding must be in order for the technology to be welcomed and eventually become part of the host community. Consequently, Ciborra writes about managers as improvisers, and writes of identity as the organisation welcomes (or not) the stranger as a guest. These ideas are about developing empathy during the systems development and deployment process, empathy which appreciates the use-situation and the disruptive and destabilising nature of new technologies. They are also deeply human and intuitive.

This intellectual tradition, traced through Gill, Mumford, Ciborra, Cooley, and many others, challenges us to rethink the values of systems analysis and design praxis. It looks outside mainstream thinking to the margins, and to focus upon those whose voice may be limited by the scientific rationality which underpins systems thinking. It also recognises that new technology has its beneficiaries and victims: it is not neutral. As Foucault reminded us, who benefits and who doesn't depends on the structures of knowledge at work, the rationality which structurally underpins institutional life (Foucault, 1980).

3.2. Rationality and the Need for Empathy in Systems Development

It is clear from the previous section that several thinkers have voiced concern about the lack of empathy for humans and their communities in systems engineering. A central problem is that of rationality.

Rationality has become a largely technical subject in systems development. A prime example of this mode of technical rationality is "instrumental rationality" (Cecez-Kecmanovic et al., 2008), which is a causal, means-end approach that seeks maximum utility, efficiency and effectiveness of action. Many formal decision theories, such as utility theory and Rational Choice Theory, have used such an approach (Boudon, 2003). Instrumental rationality has long dominated modern reasoning, and Weber (1978) noted how it was becoming universal in all spheres of life. Nozick (1993) argued that rationality shaped and controlled its own function, and that instrumental rationality was shaping the world environment into one wherein only it could flourish. Normative traits were consequently diminished in importance, or even rendered irrational. A prime example was the rationality of scientism, and the ubiquitous scientific method. However, some authors have questioned the mass "group-think" promoted by rationalities such as scientism (Klein and Lyytinen, 1985).

Various problems have been associated with a means-end, utility-driven instrumental rationality. Firstly, having an end goal or desire does not itself make it rational to seek that goal (Raz, 2005). However, instrumental rationality takes such ends as given, without assessing their rationality except as means to other ends (Nozick, 1993). Graham (1999) noted that one end usually became a means to another, and that the means-end dichotomy was therefore not as discrete as it might first seem. Secondly, uncritically pursuing ends such as efficiency has led to ineffectiveness and the unethical treatment of humans (Mintzberg, 1989, Arendt, 1963). Instrumental rationality can, therefore, be critiqued on both moral and objective grounds.

Human rationality is also bounded by cognitive limitations. Simon (1982) coined the term "bounded rationality" to refer to the notion that human rationality was inherently limited, as not all choice permutations or alternatives could be fully assessed in complex situations. Human decision-makers often face poorly defined problems with many ambiguities, and have to use incomplete information regarding alternatives, consequences, values, preferences and interests when making choices within environmentally restricted timeframes, resources and skills (March and Simon, 1958). When faced with such complexity, humans tend to use heuristics or working procedures to guide their decision-making processes in a practical, but imperfect, fashion. For instance, human actors may construct a simplified model of the choice situation and then "satisfice" the situation by using past experiences (including prejudices) and selective views of present stimuli to select familiar or "well-worn" solutions from a limited set of alternatives (Perrow, 1972). In this way they will "make do" with a familiar solution without considering all possible alternatives, even if that solution is sub-optimal. Consequently, humans could be deemed to be only partially rational insomuch that their decisions are often based on imperfect information within an artificially closed system, and are guided, consciously or unconsciously, by an admixture of environmental facts and values. The consequences of any decisions made could be intended or unintended as a result of such imperfect or bounded rationality.

Overall, instrumental rationality can be critically challenged on a number of fronts. Firstly, the instrumental pursuit of an objective does not in itself make that pursuit, or objective, rational. There is also evidence that inappropriate instrumental thinking has resulted in objective costs for businesses, and ethical costs for society. Furthermore, in complex or stochastic environments, it may be impossible to assess actions using instrumentally rational principles, due to issues such as information glut, cognitive limitations, and an inability to predict end results or utility. Utility is not synonymous with rationality, in any case, as Boudon (2003, p.17) noted that "rationality is one thing, expected utility another." Given such shortcomings of instrumental rationality, true rationality is not solely instrumental but is instead multifaceted in nature (Nozick, 1993).

Substantive rationality – an anti-thesis of the instrumental – integrates human values and preferences in the assessment of goals and desires. Hume proposed that reason was the subject of passions, and that all preferences were equally rational (Hume, 1986). Non-instrumental reasoning, guided by normative beliefs, was therefore not necessarily irrational. Nozick (1993) argued that people should not just care about causal results and utility of action, but also for what was being indicated and symbolised. Selfless and ethical action, for instance, symbolised intrinsic humanity. Instrumentalists cannot dismiss such caring – or empathy – as irrational, as they have no compatible criteria upon which to base this dismissal.

Although various rationality theories have appeared in the systems development literature, those of Weber and Habermas were pervasive (cf. Weber, 1978, Habermas, 1984). Weber considered Western rationality to be inherently instrumental in all spheres of life: the formal, the practical, and the theoretical. Weber saw formal rationalities – which had little regard for people – as omnipresent in bureaucratic domains: the law, the economy, and the state. Practical rationalities concerned the immediacy of everyday life, and were inherently egoist and means-end oriented. Theoretical rationalities were those espoused and cultivated by science and empiricism. Weber felt that instrumental rationalities were inherently opposed to human "constellations of values", and were incapable of nurturing noble values and traditions. Instrumental rationalism was ethically poor, as ideals and responsibilities tended to be overlooked for short-term egoist ends. As an alternative, Weber suggested a "substantive rationality", whereby human values had primacy. He also endorsed an open and dynamic society, wherein pluralist values challenged each other for mutual vigour and renewal.

This notion resonated strongly with Habermas, who considered various modes of rationality from a communicative perspective. Communicatory and emancipatory rationalities were exemplars of his communications-oriented thinking. Communicative rationality sought inter-subjective agreement and understanding amongst rationally motivated participants. Consensus was gradually achieved though communication and the reciprocal exchange and challenging of validity-claims. The efficacy of this approach is, however, impacted by contextual coercions, confusion and schizophrenic responses caused by double binds (Bateson, 1972). Emancipatory rationality involved recognising and pursuing emancipatory potential by identifying and removing barriers and other conditions to improve the potential for free rational discourse. It sought communicative rationality without coercion or power distortions. Habermas also felt that the instrumental rationality promoted by scientific and technological thought had become too overreaching, and was reducing social and political issues into matters of technical rationality. In response, he believed a broader notion of rationality could help society maximise the advantages offered by technological advancement whilst minimising the disadvantages (Ngwenyama, 1991).

There has been broad support in the systems development literature to critically reassess the dominance of instrumental rationalities that pervade the discipline (Avgerou, 2000, Vickers, 1999, Robinson et al., 1998, Klein and Lyytinen, 1985), and for substantive rationalities, such as the communicative, to be employed to improve systems success (Visala, 1996). A number of rationality frameworks have also been proposed for systems development. For instance, Klein and Hirschheim (1991) offered the following rationalities: formal, substantive, communicative, and emancipatory. The first two rationalities were from Weber, and the second two from Habermas. Cecez-Kecmanovic et al. (2002) presented a rationality framework for studying information systems, which contained a similar set of rationalities: formal/instrumental, substantive, quasi-communicative, and communicative. Cecez-Kecmanovic et al. (2002) dissented from Klein and Hirschheim (1991) in that they saw no need for a separate emancipatory rationality, as they deemed it to be achievable through the communicative. Various socio-technical or soft systems methodologies have also been developed to incorporate broader and human-centred forms of rationality into systems development (Avison and Fitzgerald, 1995, Mumford, 2000).

In short, the need to look beyond instrumental rationality to incorporate other forms and modes of rationality has therefore been widely noted in the information systems literature (Avgerou, 2000; Cecez-Kecmanovic et al., 2002; Klein and Hirschheim, 1991; Klein and Lyytinen, 1985; Stapleton, 2006). Nevertheless, Cecez-Kecmanovic et al. (2008, p.126) observed that most mainstream information systems engineering research “has not questioned the dominant instrumental rationality in … practice.” This needs to be critically challenged for substantive, communicative and emancipatory forms of rationality to propagate in systems development practice and so that systems development engineers have empathy for the people who are impacted by these systems.

3.3. The Human-Centred Tradition and Empathy

The previous section argued that systems development has to become less instrumentally rational or functionalist in nature in order for human values and needs to be recognised and incorporated. One potential mode of approach for achieving this may be found in the human-centred tradition, which places human needs, purpose, skill, creativity and potential at the heart of human organisations and technical systems design (Gill, 1996). The human-centred movement in Europe emerged in the 1970s as a counterbalance to Taylorism and the growing instrumental culture of the time (Gill, 2012). A tenet of human-centred development is that people are considered first, organisations second, and technology third (Brandt and Cernetic, 1998). Human-centred systems are designed to complement human skill and to serve human needs for information, assistance and knowledge (Kling and Star, 1998). The human-centred tradition has an underlying belief that new technologies are for the benefit of all people and all societies (Gill, 1996). Technology design should, therefore, be concerned not only with technical feasibility but also with social desirability, which would consider local cultural values and customs. The human-centred approach is therefore an empathy-oriented paradigm of systems development that is well suited to improving international stability.

Human-centred system design recognises that complex computer systems structure social relationships and not just information. The individual worker in an organisation is also recognised as an integral member of the wider society, and not just an isolated atomic organisational component (Gill, 1996). Human centred systems design should be ecological, thus accounting for the holistic system development, use, infrastructure, global concerns and environmental issues (Kling and Star, 1998). Brandt and Cernetic (1998) noted that people have intrinsic needs, and that these should be supported by human-centred systems. Examples include the need for people to develop themselves, to experience challenges, to be creative, to be motivated, to experience job satisfaction, and to have ample opportunities to use their tacit knowledge, ingenuity and skills. The human-centred design approach therefore recognises the inherent value in allowing people to realise intrinsic and personal needs. These human needs may not be directly related to the technical system or immediate systems context, but instead contribute on a wider level by enabling better use, transfer and deployment of knowledge and skill. The human-centred approach thus seeks to combine human ingenuity with technological innovation in a way that enhances productivity and enriches human expertise (Gill, 2012). Empathy for human needs and values is a pathway for harnessing human potential in an ethical and sensitive fashion, and this is a core tenet of the human-centred tradition.

3.4. Virtues, Ethics, Empathy and Systems Development Engineers

Empathy is a manifestly human trait that, although natural and instinctive to many, must also be nurtured and developed (Alligood, 2005). It is therefore necessary to look to those humans in whom empathy must manifest in systems development practice: the systems development engineers. Systems development engineers make choices that significantly affect the systems development process and its outcomes, and these choices depend heavily on their personal value systems, beliefs and ethical dispositions (Kumar and Bjorn-Andersen, 1990, Kreie and Cronan, 2000, Davison et al., 2006). These decisions are not ethically neutral (Wood-Harper et al., 1996), and engineers must therefore endeavour to act as "moral agents" in the systems development process due to their proximity, knowledge and position of influence (Walsham, 1993), even if individual moral agency may be environmentally constrained (Conlon and Zandvoort, 2011). The personal values of systems engineers are consequently embedded in system designs and proliferate through system implementation artefacts and dissemination choices (Brey, 2000, Friedman, 1996). The decisions made by a few systems engineers therefore hold the potential to affect broad collectives of people who are impacted, on many levels, by technological systems development. It is therefore crucial that systems engineers have empathy for the people affected, and that their choices are influenced by appropriate human-centred values that afford such empathy to manifest.

Professional ethics, which concerns the application of ethical theory to the workplace, can provide guidance in many respects to systems development engineers through professional codes of conduct, for instance (Johnson, 2009). However, given the complex, heterogeneous and dynamic contexts in which systems development engineers may find themselves, it is often difficult to provide detailed or prescriptive guidance for all eventualities in practice. Various concerns have therefore been raised regarding the individualistic approach to ethics education and training, which uses ethical-response scenarios that are oversimplified and naïve regarding the broader social, organisational and political complexities of engineering practice (Conlon and Zandvoort, 2011). In response, there has been increasing support for "virtue ethics" to inform ethical (or empathy-oriented) systems development (Gotterbarn, 1999, Grodzinsky, 2000, Carew et al., 2008). Instead of relying on strict ethical rules or duties to inform personal action, virtue ethics focuses on developing moral character and disposition (Johnson, 2009). It seeks to identify, espouse, promote, and nurture desirable characteristics or virtues. It essentially promotes virtues that should always be followed in practice and, notionally, a choice would only considered ethical if a virtuous person would have done likewise. The virtue ethics approach accepts and embraces the fact that personal values inform personal action on a practical level, and that impacting the underlying moral dispositions or character of the decision maker can influence the decisions themselves. Empathy in systems development can thus be fostered by developing desirable virtues or characteristics in systems development engineers. Indeed, the classical cardinal virtues of prudence, justice, temperance and fortitude (St. Ambrose, c.391) are themselves highly compatible with the concept of empathy: prudence requires a duty of care or carefulness in judgement; justice requires the consideration of others and their rights for distributive fairness; temperance denotes a degree of moderation, reserve and respectfulness for what is already in place; and fortitude denotes the courage to act or do something in praxis to defend and promote what is right.

4. An Empirical Study of Empathy in Systems Development

4.1. Background

The remainder of this paper focuses on presenting an empirical analysis of the manifestation of human-centred empathy in the systems development process (Research Question 1) and systems development engineers (Research Question 2). The findings of the analysis are subsequently used to consider the implications for international stability (Research Question 3). The data used for the analysis presented was originally collected as part of a critical-interpretive study of the meaning, value and role of privacy in information systems development (ISD) (cf. Carew, 2009). The study adopted a multi-method approach, and collected various quantitative and qualitative data in order to reinforce and triangulate its findings. Although the original study focussed primarily on the concept of privacy for ISD, the data obtained during the study allow for further secondary analyses into broader aspects such as ethical values, rationality and behaviour in systems development to search for evidence of human-centredness and empathy.

4.2. Methodology

4.2.1. Survey

One aspect of the original study was an electronic self-administered survey of ISD professionals working in Ireland, which was completed by 56 respondents (n=56). The diverse respondents were both male (n=36) and female (n=20) ISD professionals who worked in various industry sectors. These respondents were, in general, highly experienced professionals, with an average of 11.5 years industry experience, and highly educated, with

86% holding an honours bachelors degree or higher. Likert scale-type questions and rankings were used throughout the self-administered survey, and respondents could also provide free text commentary throughout.

In order to consider Research Question 1 systematically, the systems development process was considered in terms of (1) the goals of systems development, (2) the rationality of systems development, and (3) the focus of systems development. The scaled and ranked data on systems development goals, rationality and focus collected as part of the original study were thus subjected to further analysis to ascertain whether or not they were human-centred and exhibited empathy. Systems development goals, rationalities, and focus were considered systematically and in turn. The human-centred analysis used for each of these was threefold. Firstly, the data was analysed using descriptive statistics (frequencies, percentages, means, standard deviations, and ranks) to summarise the original responses. Secondly, the data was subjected to principal components analysis (PCA) in order to reduce and simplify the data, thus revealing what latent variables, factors or components accounted for most variance in the data. Varimax rotation was used to maximise discreteness in the component loadings at all times. Two component (or factor) models were used for PCA in all cases as this accounted for the majority of variance in all cases, and so the component loadings could be cogently analysed and plotted in two dimensions. Eigenvalues also fell below 1.00 after two components for both systems development rationalities and focus, whilst only remaining marginally above 1.00 at 1.070 for systems development goals. Thirdly, and finally, hierarchical clustering was performed on the data to further investigate and validate the latent clustering identified through PCA. Average linkages between groups, based on squared Euclidean distances, were used for calculating the clustering coefficients. The focus of these analyses was on evidence of human-centredness (and, consequently, empathy) in the data set – whether it is well supported in the data as an integral, important and rational goal in systems development, and whether the focus of systems development facilitates and ascribes to its people-before-organisations-before-technology ideal.

4.2.2. Q Methodology

Q methodology formed another major component of the original multi-method study, and was used to identify the factors that encapsulated the primary distinct sentiments, voices or factions of option in the research domain. Q methodology is a "systematic and rigorously quantitative means for examining human subjectivity" (McKeown and Thomas, 1988, p.7). It combines the individual strengths of quantitative and qualitative research approaches to reveal the subjectivity involved in any situation (Brown, 1996). In essence, Q methodology provides a well-formed mechanism for identifying different factions of opinion on any subjective topic by allowing for an oblique revelation of the primary "voices" or "sentiments" surrounding the topic or concourse. Once elicited and interpreted, these collectively enable a deep insight into the varied and concurrent voices that are both complementary and competing in the domain being investigated.

Q methodology studies are conducted as follows. Firstly, participants (the "P sample") are presented with a set of carefully chosen statements or artefacts (the "Q sample"), which represent the concourse of the topic in miniature. Participants are then asked to subjectively sort the Q sample items relative to each other according to a clearly given instruction; for instance, to show relative agreement, relative liking or relative comfort. The sort is usually restricted to a quasi-normal distribution, whereby fewer Q sample items can be placed at the extremes than towards the centre. Based on these "Q sort" results, all participants are subsequently correlated to each other holistically and without being reduced to a series of traits or variables. From these correlations, a series of orthogonal factors are extracted that represent underlying sentiments, commonalities, clusters, or factions among the participants. Factor scores are then calculated for all the Q sample statements (or artefacts), indicating the typical sorted value given to each by proponents of each factor. These factor scores allow for qualitative interpretation and for meaning and linguistic labels to be ascribed to each factor.

A 34 statement Q sample was used to represent the concourse of the research domain, and a P sample of 37 ISD professionals in Ireland completed the Q sort as instructed as part of the wider critical-interpretive study. This Q sort data was then analysed following the tenets of Q methodology as previously outlined in this section. Four primary orthogonal factors were identified in the Q sort data collected. These four factors were subsequently interpreted in a holistic fashion as required under Q methodology using the derived factor scores and, as these represent the primary sentiments among the respondents, were used to address Research Question 2.

5. Analysis and Findings: Process (Research Question 1)

This section considers Research Question 1, namely:

> *RQ1. Does the systems development process exhibit empathy?*

As previously noted in section 4.2.1, in order to consider this research question systematically, the systems development process is considered in terms of (1) the goals of systems development, (2) the rationality of systems development, and (3) the focus of systems development.

5.1. Systems Development Goals

Table 1 summarises the responses obtained regarding the perceived importance and ranking of goals in systems development.

A number of potential goals can drive systems development. In your opinion, please rank the following goals according to their level of importance.								
	1 **Most Important**	**2**	**3**	**4**	**5** **Least Important**	**Mean**	**Std. Dev.**	**Mean Rank Order**
Efficiency	21.4% (12)	26.8% (15)	32.1% (18)	10.7% (6)	8.9% (5)	2.59	1.203	3
Empowerment of People	5.4% (3)	21.4% (12)	16.1% (9)	46.4% (26)	10.7% (6)	3.36	1.103	4
Competitive Advantage	41.1% (23)	21.4% (12)	17.9% (10)	12.5% (7)	7.1% (4)	2.23	1.307	1
Productivity	26.8% (15)	28.6% (16)	28.6% (16)	10.7% (6)	5.4% (3)	2.39	1.155	2
Humanitarian Reasons	5.4% (3)	1.8% (1)	5.4% (3)	19.6% (11)	67.9% (38)	4.43	1.059	5

Table 1. Systems Development Goals

It is clear from Table 1 that human-centred goals, such as empowerment and humanitarian reasons, were generally ranked well below more functionalist goals such as productivity, efficiency and competitive advantage. PCA was next performed on the data to further investigate this pattern. Table 2 presents the component loadings (along with Eigenvalues and explained variances) and Figure 1 plots the component loadings for the goals.

Goal	Component 1	Component 2
Efficiency	-.492	.659
Empowerment of People	.786	-.033
Competitive Advantage	-.267	-.895
Productivity	-.592	.071
Humanitarian Reasons	.715	.313
Initial Eigenvalues	1.804	1.330
Cumulative % of Variance	36.080	62.673

Table 2. PCA of Systems Development Goals

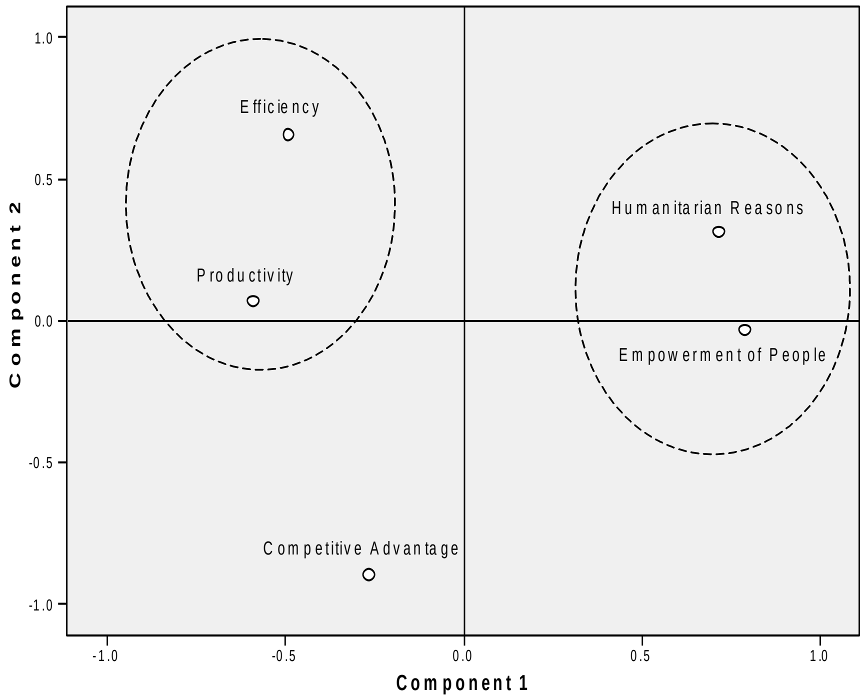

Figure 1. Component Plot of Systems Development Goals

The PCA confirms the clear separation and distinction of the human-centred goals from the more functionalist ones. This separation can be most clearly seen in Figure 1, where the two main groupings or clusters of goals have been highlighted. Component 1 appears to primarily represent or encapsulate this distinction. The analysis does, however, also demonstrate that competitive advantage, which was ranked as the most important goal overall in Table 1, was perceived differently to efficiency and productivity (which are closer in the component space). This suggests that not all respondents only associated competitive advantage with functionalist goals, but perhaps also with humanist ones. Competitive advantage through human-centred means, therefore, remains a possibility. To further investigate this emergent pattern, hierarchical clustering was next performed on the data set. Figures 2 and 3 present the vertical icicle and dendrogram diagrams respectively, which summarise the hierarchical clustering of systems development goals.

	Case								
Number of clusters	Humanitarian Reason		Empowerment of Peop		Competitive Advantag		Productivity		Efficiency
1	X	X	X	X	X	X	X	X	X
2	X	X	X		X	X	X	X	X
3	X	X	X		X		X	X	X
4	X	X	X		X		X		X

Figure 2. Vertical Icicle of Systems Development Goals

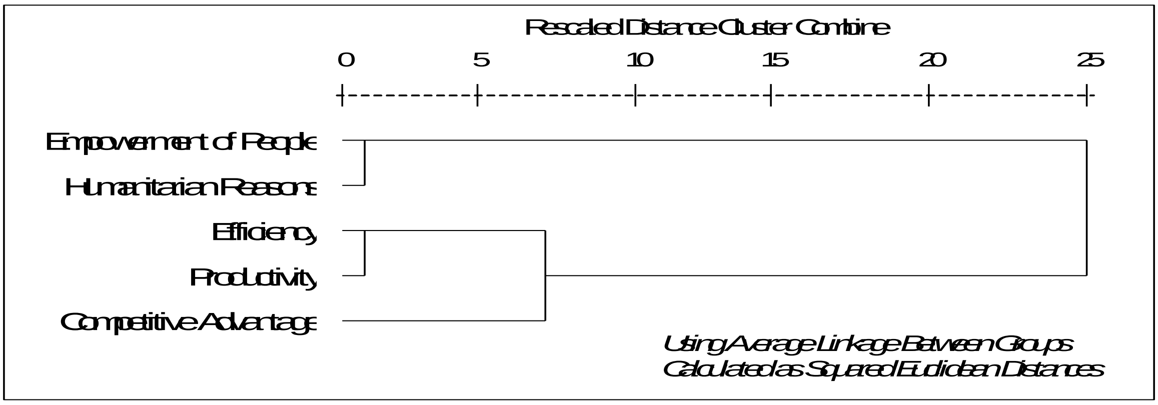

Figure 3. Dendrogram of Systems Development Goals

The hierarchical clustering analysis confirms that the human-centred goals of empowerment and humanitarian reasons were most closely associated, as they were the first to cluster, followed by the functionalist goals of productivity and efficiency, which were next to cluster (see Figure 2). Competitive advantage subsequently clustered with the functionalist goals. Figure 3 demonstrates that competitive advantage was, nevertheless, comparatively distant to the first two functionalist goals. It therefore confirms the pattern observed under PCA in Figure 1 that competitive advantage was quite distinct and separate in itself, and did not inevitably align with overtly functionalist goals. However, hierarchical clustering in Figure 3 demonstrated that competitive advantage eventually clustered with functionalist goals, and that the resulting cluster was notably distant from the human-centred cluster.

In summary, although some respondents ascribed great importance to them, human-centred goals ranked notably lower than functionalist goals in terms of perceived importance (see Table 1). They were also highly separate and distinct from functionalist goals, as demonstrated by PCA and hierarchical clustering. Although there was some recognition that competitive advantage did not necessarily derive only from functionalist goals like productivity and efficiency, it was closer in general to these goals than to more human-centred ones. On the whole, there was little evidence that systems development goals are human-centred and, indeed, there was evidence to the contrary.

5.2. Systems Development Rationality

Table 3 summarises the responses obtained regarding various rationality perspectives for systems development.

In your opinion, how rational are the following perspectives for modern systems development?								
	1 Not Rational	**2**	**3**	**4**	**5 Very Rational**	**Mean**	**Std. Dev.**	**Mean Rank Order**
To Deliver Useful Tools	3.6% (2)	5.4% (3)	1.8% (1)	26.8% (15)	62.5% (35)	4.39	1.021	1
To Help Humans Communicate Effectively	1.8% (1)	7.1% (4)	8.9% (5)	35.7% (20)	46.4% (26)	4.18	0.993	2
To Reduce Coercion	14.3% (8)	16.1% (9)	37.5% (21)	25.0% (14)	7.1% (4)	2.95	1.135	5
To Symbolise Ethical Practice	10.7% (6)	28.6% (16)	33.9% (19)	19.6% (11)	7.1% (4)	2.84	1.092	6
To Allow for Efficient Control	3.6% (2)	17.9% (10)	16.1% (9)	42.9% (24)	19.6% (11)	3.57	1.110	3
To Improve the Human Condition	16.1% (9)	10.7% (6)	16.1% (9)	33.9% (19)	23.2% (13)	3.38	1.383	4

Table 3. Systems Development Rationality

Table 3 illustrates that human-centred rationalities such as ethical practice, reducing coercion, and improving the human condition, were generally deemed to be less rational than functionalist/instrumental rationalities such as delivering tools, enabling efficient control, and effective communication. As before, PCA was performed on the data to further investigate this emergent pattern. Table 4 presents the component loadings (along with Eigenvalues and explained variances) and Figure 4 plots the component loadings for the rationality perspectives.

Rationality Perspective	Component 1	Component 2
Useful Tools	-.457	.777
Communicate Effectively	.097	.890
Reduce Coercion	.810	.191
Ethical Practice	.861	-.211
Efficient Control	.207	.712
Human Condition	.781	.106
Initial Eigenvalues	2.283	1.980
Cumulative % of Variance	38.052	71.048

Table 4. PCA of Systems Development Rationality

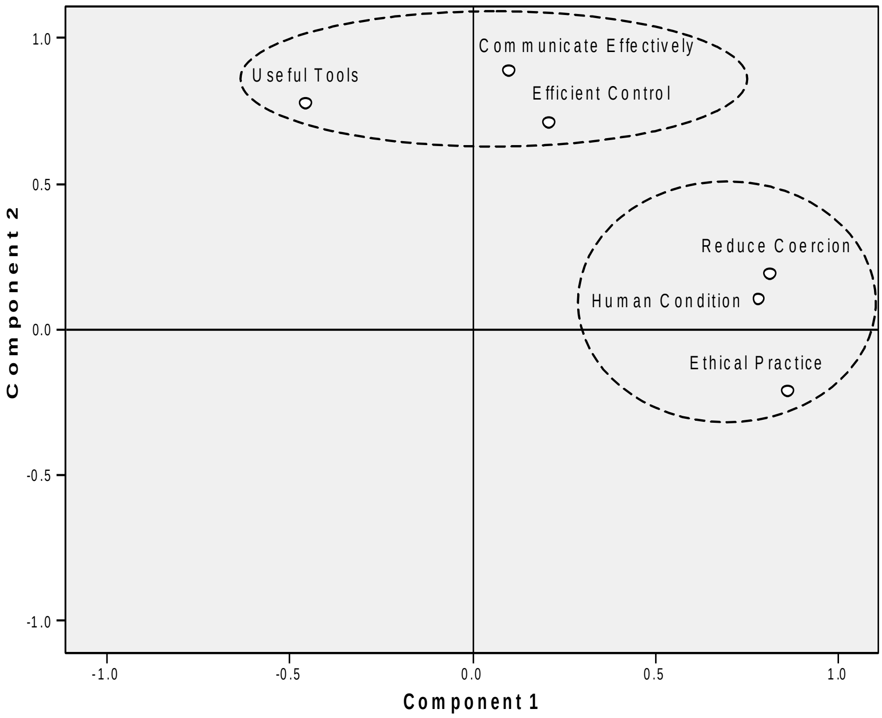

Figure 4. Component Plot of Systems Development Rationality

The PCA once again confirms the separation and distinction of the human-centred rationalities from the more functionalist ones. This separation can be most clearly seen in Figure 4, where the two main groupings or clusters of rationalities have been highlighted. Component 1 appears to primarily represent or encapsulate human-centred rationality, whilst Component 2 represents a more functionalist/instrumental rationality. To further investigate this emergent pattern, hierarchical clustering was once again performed on the data set. Figures 5 and 6 present the vertical icicle and dendrogram diagrams respectively, which summarise the hierarchical clustering of systems development rationality perspectives.

	Case										
Number of clusters	Human Condition		Ethical Practice		Reduce Coercion		Efficient Control		Communicate Effectivel		Useful Tools
1	X	X	X	X	X	X	X	X	X	X	X
2	X	X	X	X	X		X	X	X	X	X
3	X	X	X	X	X		X		X	X	X
4	X		X	X	X		X		X	X	X
5	X		X		X		X		X	X	X

Figure 5. Vertical Icicle of Systems Development Rationality

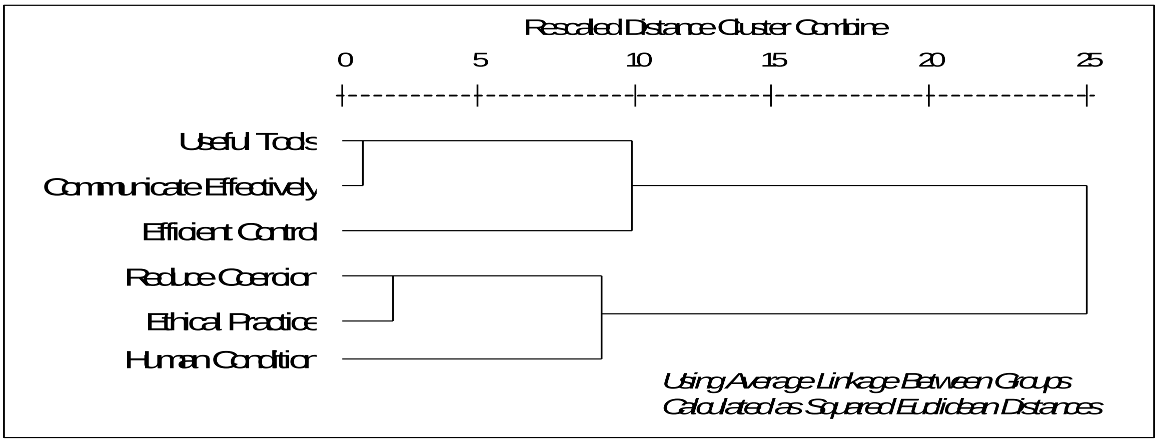

Figure 6. Dendrogram of Systems Development Rationality

The hierarchical clustering analysis confirms the grouping of rationality perspectives for systems development into two categories: functionalist/instrumental rationality and human-centred rationality. Figure 6 demonstrates the sizable cluster distance between these final two categories before the final cluster combine. The analysis also highlights that communicating effectively, although potentially an empowering human-centred perspective, was actually seen as something more instrumental or utilitarian by respondents as it was the first to cluster with useful tools (see Figures 5 and 6). Furthermore, communicating effectively subsequently clustered with efficient control, thus demonstrating that it had no discernible emancipatory sentiment based on the sample data. As noted in section 3.2, communicative rationality was potentially impacted by contextual factors that resulted in confusion, double binds, schizophrenic responses and coercion. Free and rational communication required emancipation from such inhibiting contextual factors or barriers. The complex nature of rationality also reminds us that effective communication may not always be desirable if what is communicated, for instance, confuses, coerces, is erroneous, or induces a schizophrenic response. Similarly, coercion may also not be undesirable when applied to irrational individuals and groups in given situations, though we must be very careful not to uncritically deem divergent or radical ideas as irrational simply because they challenge the status quo. Further contextual data would be required to understand such nuances, though.

In summary, although some respondents deemed human-centred perspectives for systems development to be rational, these were generally not deemed to be as rational as more functionalist, instrumental or utilitarian rationalities (see Table 3). Human-centred rationality was also separate and distinct from functionalist rationality, as demonstrated by both PCA and hierarchical clustering. On the whole, there was little evidence that systems development rationality is human-centred and, indeed, there was evidence to the contrary.

5.3. Systems Development Focus

Table 5 summarises the responses obtained regarding the perceived importance and ranking of three issues in systems development, which determine its focus.

Please rank the following in terms of how important you think they are for information systems development.				
	1 **Most Important**	**2**	**3** **Least Important**	**Rank Order** *(Mean, Median and Mode)*
Organisational Issues	57.1% (32)	33.9% (19)	8.9% (5)	1
Individual Personal Issues	8.9% (5)	12.5% (7)	78.6% (44)	3
Technical Issues	33.9% (19)	53.6% (30)	12.5% (7)	2

Table 5. Systems Development Focus

Brandt and Cernetic (1998) lucidly summarised the human-centred approach to systems development as people first, organisations second, and technology third. With this ideal in mind, Table 5 illustrates that systems development does not have a human-centred focus, with both organisational and technical issues being deemed more important than individual personal issues. To further analyse this issue, following the human-centred ideal of people-before-organisations-before-technology, Figure 7 summaries the percentage of respondents who answered the question from Table 5 in all six permutations possible. This "POT-TOP analysis" is organised so people (P) always have precedence, followed by organisations (O), followed by technology (T). It offers a summary of the human-centredness of systems development from most human-centred (POT) to least human-centred (TOP).

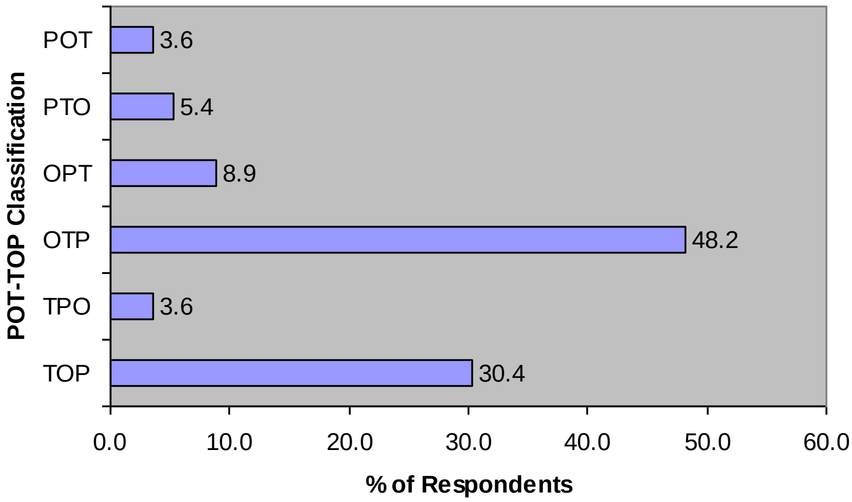

Figure 7. POT-TOP Analysis of Human-Centredness

As demonstrated in Figure 7, only 3.6% of respondents ascribed to the human-centred ideal, and 78.6% deemed people (individual personal issues) to be least important overall. Figure 7 does, however, also demonstrate that there was notable disagreement on whether organisational or technical issues were most important. PCA was once again performed on the data to investigate this pattern. Table 6 presents the component loadings (along with Eigenvalues and explained variances) and Figure 8 plots the component loadings for the focus issues.

Focus	Component 1	Component 2
Organisational Issues	-.844	-.537
Individual Personal Issues	-.056	.998
Technical Issues	.907	-.421
Initial Eigenvalues	1.541	1.459
Cumulative % of Variance	51.364	100.000

Table 6. PCA of Systems Development Focus

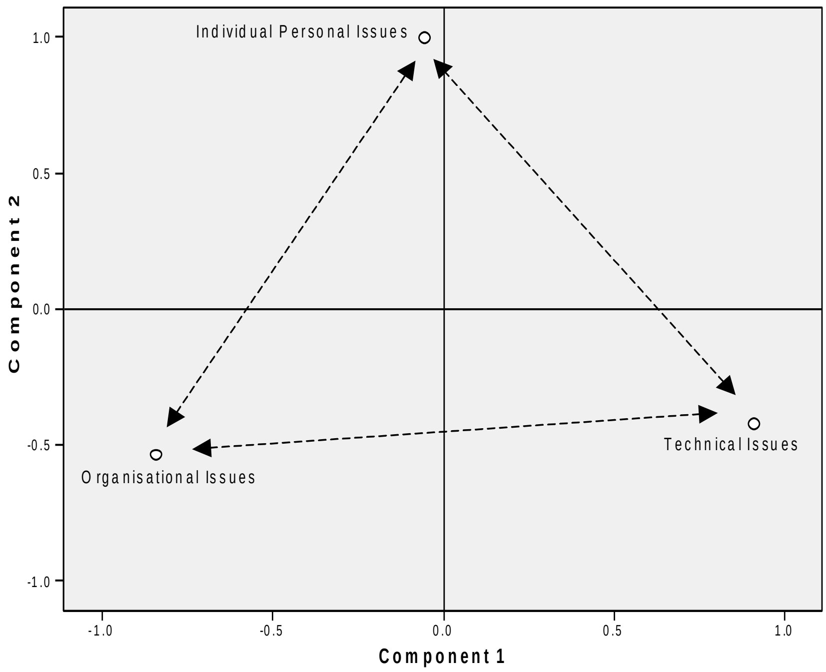

Figure 8. Component Plot of Systems Development Focus

In this case, PCA extracted two components that explained 100% of the variance in the data (see Table 6). However, Figure 8 illustrates that all three focus issues were extremely disjointed in the component space, and thus formed a triadic or three-way polarisation. This further demonstrates that opinion is markedly divided over the precedence of focus issues in systems development. To explore this pattern further, hierarchical clustering was again performed on the data set. Figures 9 and 10 present the vertical icicle and dendrogram diagrams respectively, which summarise the hierarchical clustering of systems development focus issues.

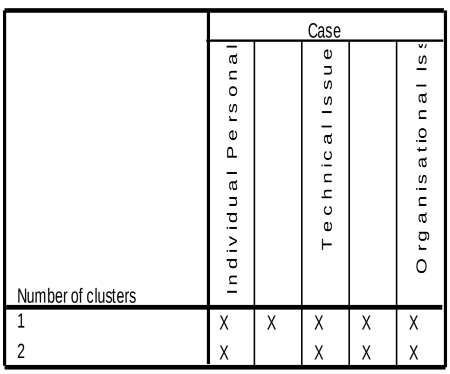

Figure 9. Vertical Icicle of Systems Development Focus

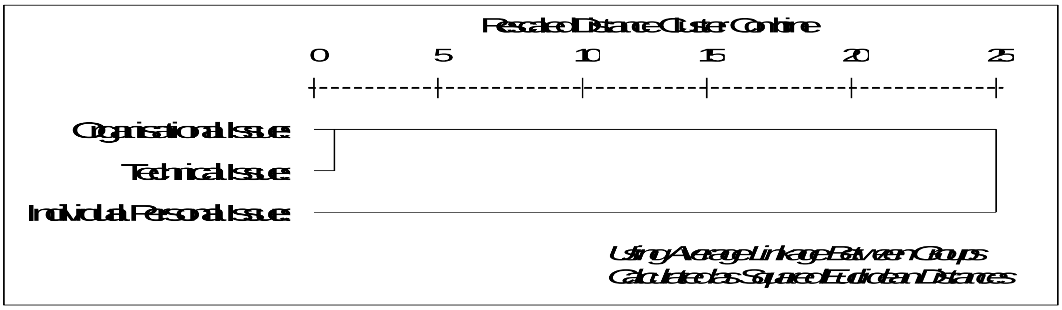

Figure 10. Dendrogram of Systems Development Rationality

The hierarchical clustering analysis demonstrates that, despite the divergence in opinion shown under PCA, organisational and technical issues clustered together first (see Figure 9), and the resultant cluster was markedly distant to the individual personal issues cluster (see Figure 10).

In summary, there was little evidence that the focus of systems development is human-centred and, indeed, there was evidence to the contrary. The majority of respondents were divided in opinion between whether organisational or technical issues were more important in systems development, with comparatively few giving precedence to individual personal issues. This is contrary to the human-centred philosophy of putting people first.

5.4. Discussion

The analysis presented in this section has demonstrated that contemporary systems development is not fundamentally human-centred and, consequently, lacks empathy. Human-centred goals, rationality and focus issues were shown to be markedly distinct to, and separate from, their functionalist or instrumental counterparts. Human-centred notions also attracted comparatively less support overall.

However, the analysis does highlight some potential opportunities where human-centred thinking could be usefully harnessed. The analysis of systems development goals in Section 5.1 demonstrated that competitive advantage was perceived as quite distinct from other goals. If the benefits of human-centred systems development for competitive advantage could be more widely promoted and propagated in practice then human-centredness may be deemed more rational to that end. Furthermore, the analysis presented in Section 5.3 demonstrated the general divide between having organisational or technical issues as the focus of systems development. If the collective organisational benefits that might come about from focussing on individuals within an organisation were cogently reified then the distance between people and organisations may be reduced. Technical and instrumental goals and rationalities were demonstrated as highly separate to human-centred ones throughout.

6. Analysis and Findings: People (Research Question 2)

This section considers Research Question 2, namely:

RQ2. Do systems development engineers exhibit empathy?

As noted in section 4.2.2, Q methodology was used to uncover the major latent sentiments of systems development professionals. Four primary orthogonal factors were identified in the Q sort data collected, which encapsulated the strongest overarching sentiments therein. Once identified, these four factors were subsequently interpreted in a holistic fashion as required under Q methodology using their derived factor scores. This section presents a brief overview of the four emergent factors. It then considers the four-factor model in simpler terms – as two axes and three dimensions – in order to highlight factor divergences and synergies. Finally, it considers the implications of the four-factor model for empathy in systems development.

6.1. The Four-Factor Model

Factor 1 demonstrated a clear convergence with the individualistic philosophy of existentialism, which holds that free will and responsibility for one's choices are absolute, and rejects notions of fatalism whereby one is powerless to effect change (Sartre, 1973). Existentialism also incorporates a concern for society, which can be realised and fostered through the individual, and this factor similarly demonstrated some inclinations towards human, social, and moral issues. Because of its strong resonance with the precepts of the philosophy of existentialism, this factor was labelled "Existentialist."

Factor 2 adopted a broad humanitarian perspective of the information systems domain, and advocated the socio-technical approach to systems development. It embodied a wide and transcendental worldview of the information society, one that placed the human person at its very centre. Given its social focus and concern regarding the person and their personal values, rights, and dignity in the information society, this factor was labelled "Humanist."

Factor 3 embodied a techno-centric perspective of systems development, wherein hard methodologies were used and technical function was the goal. It also exhibited a general apathy and indifference towards the social or moral implications of systems development. Given its focus on technical artefact, function, and hard methodological approaches to systems development, this factor was labelled "Technocentrist."

Factor 4 primarily reflected a commerce and industry-centred rationality for ISD, whereby economic pursuits were central and ISD activities were largely guided and regulated by wider industry trends. The factor also exhibited a discernable "instrumental rationality" (Nozick, 1993), whereby both technology and people were valued in instrumental terms. There was also a discernable sense of disempowerment and fatalism underpinning the factor, which suggested that industry trends and economic priorities were inevitable and could not be challenged. Overall, the factor embodied adherence to industry trends and regulation, deference to economics, instrumental rationality, and generally conveyed a fatalist or disempowered sentiment. Combining the two major themes of industrialism and fatalism, this factor was labelled "Industriofatalist."

In summary, the four orthogonally discrete factors elicited using Q methodology were labelled Existentialist, Humanist, Technocentrist and Industriofatalist. These four factors collectively accounted for the primary overarching sentiments found in the systems development domain.

6.2. The Four-Factor Model as Two Axes

Although the four factors were orthogonal, other survey data collected as part of the study suggested that at an aggregate level it was also possible to consider the four-factor model in the simpler terms of two axes. There was broad sample evidence that the Industriofatalist sentiment was dominant in the systems development domain, and it was generally opposed to Humanist notions and values. Furthermore, the Industriofatalist sentiment exuded a marked fatalism, and respondents deemed its dominant, commercially instrumental rationality to be highly immutable. This highlighted the conflict between the Industriofatalist and Existentialist sentiments; between fatalism and empowerment. On the whole, the Industriofatalist values appeared to supplant the Humanist/Existentialist ones. Although the Industriofatalist sentiment was indifferent to Technocentrist values, their mutual instrumental focus rendered them compatible. This suggested that two bi-polar axes existed in the systems development domain: Humanist/Existentialist and Technocentrist/Industriofatalist. The

Humanist/Existentialist axis was deemed more compatible with ethical issues in systems development, but the Technocentrist/Industriofatalist axis was evidently more prevalent.

6.3. The Four-Factor Model in Three Dimensions: Power, Social Focus and Responsibility

The four factors were also considered in a three dimensional space in order to further highlight the major differences and similarities between them. The three dimensions used were: power, social focus, and responsibility. Power refers to the perceived level of personal influence or freedom associated with a factor. Social focus refers to the level of interest or engagement a factor displayed concerning social aspects, as opposed to purely technical or functional issues. Finally, the responsibility dimension is an amalgamation of the related concepts of morality, accountability, and responsibility. The four factors were approximated for each dimension using their original Q methodology factor scores. Figure 11 illustrates the four factors on the three dimensions.

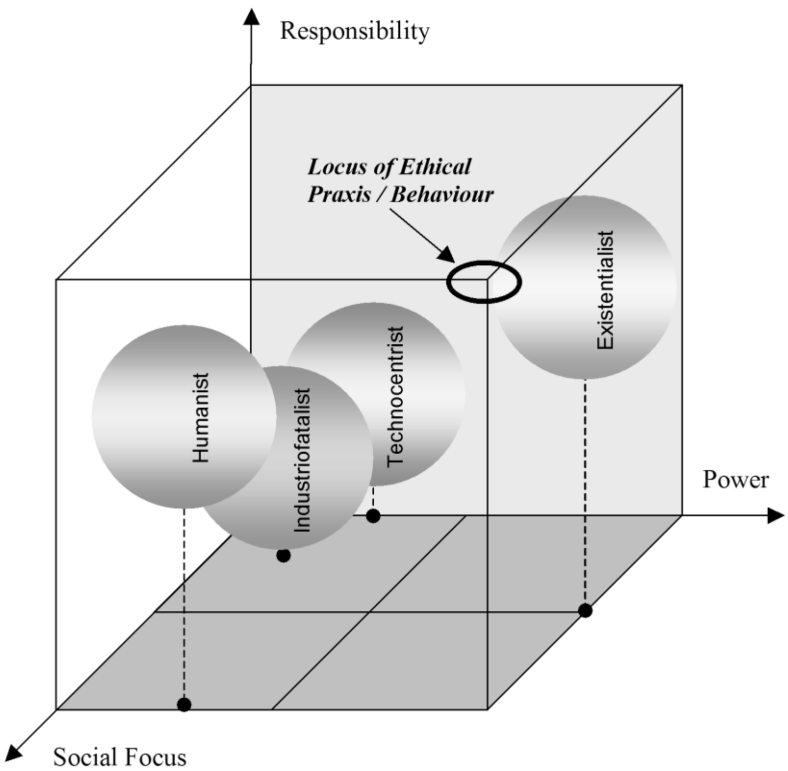

Figure 11. A Three-Dimensional Perspective of the Factor Model

Figure 11 illustrates that the Humanist factor is most deficient on the power dimension, suggesting that it would unlikely induce strong ethical praxis by itself. Similarly, the Existentialist sentiment is most deficient on the social focus dimension. Consequently, although its social dimensional loading is moderate, the Existentialist sentiment is not as cognisant of social and human values as the Humanist factor. Therefore, it is unlikely that the Existentialist person values social concepts to the same degree as the Humanist. This observation is also consistent with the classical view of existentialism as being innately individualistic (Sartre, 1973). Both the Technocentrist and Industriofatalist factors are deficient on all three dimensions. They recognise little responsibility beyond that inherent in immediate functionalist aspirations, adopt a fatalist and disempowered perspective, and display indifference to social impacts or considerations.

This three dimensional analysis reinforces the notion that two major bi-polar axes underpin the systems development domain. The instrumentally focussed Technocentrist/Industriofatalist axis strengthens towards the origin point of Figure 11, as personal power, responsibility and social focus dissipate. Conversely, the Humanist/Existentialist strengthens as personal power, responsibility and social focus are increased. The "locus" of ethical praxis or behaviour in Figure 11 demonstrates the Humanist/Existentialist axis at its pinnacle. At this point, human issues, rights and values are recognised as paramount (Humanist) and are actively promoted and protected in practice (Existentialist). Note that neither the Humanist nor Existentialist factors are sufficient in themselves to induce ethical behaviour, as there is a separation of Humanist care and Existentialist praxis. Both are needed in tandem to contest Technocentrist/Industriofatalist tendencies.

6.4. Discussion

The analysis presented has highlighted that although some systems development engineers do exhibit empathy through the Humanist sentiment, they may not act on it in praxis given the discrete nature of the orthogonal Existentialist sentiment. Furthermore, two of the major barriers to ethical and empathy-centric behaviour in systems development are a highly immutable and dominant instrumental rationality, and a broad sense of disempowerment. This position can be cogently represented as the Technocentrist/Industriofatalist axis, and it represents a major challenge to ethical behaviour as it promotes a mode of rationality that is not well suited to recognising or promoting human values or human-centred notions such as empathy.

The view that instrumental rationality is myopic when it comes to human and societal issues has been broadly recognised in the literature. Kincheloe and McLaren (2000) argued that instrumental/technical rationality is one of the most oppressive features of modern society, and rebuked it as “hyperreason” that involves an obsession with means in preference to ends. Nozick (1993) argued that rationality shaped and controlled its own function and that, by suppressing alternatives, instrumental rationality was shaping the world environment into one wherein only it could flourish. For instance, Cecez-Kecmanovic et al. (2008, p.126) noted how “technical codes” used in the systems development process were being used to invisibly “inscribe values and interests of the dominant groups, and thereby strengthen their domination and routinize their exercise of power.” Such codes and methodologies, therefore, provide and foster false narratives that are incapable of embodying and protecting concepts and values beyond their limited vocabularies; local cultural values, beliefs, human rights, and empathy, for instance.

As noted in section 3.2, although the need to look beyond instrumental rationality to incorporate other forms and modes of rationality has been widely recognised in the systems engineering literature, most mainstream information systems engineering research has not questioned the dominance of instrumental rationality in practice. The pervasiveness of the Technocentrist/Industriofatalist axis in contemporary society, and the need to critically contest its precepts, therefore remains a challenge if concepts such as empathy and human-centredness are to be fostered.

7. Fostering Empathy for International Stability (Research Question 3)

This section considers Research Question 3, namely:

> *RQ3. How can empathy be fostered in systems development in order to support international stability?*

The previous sections have noted that systems development is not human-centred and, therefore, lacks empathy. Both the systems development process, and the professional systems development engineers involved, adhere to a predominantly instrumentally rational worldview. Although this mode of rationality is not intrinsically immoral or disordered – indeed, it the *de facto* manner in which most engineers work – it tends to be myopic or indifferent towards human and socially centred values and issues in its pursuit of instrumental goals. The need to incorporate such societal issues, concerns and values into mainstream systems engineering has been recognised for some time, and there is consequently a need to change the context within which engineers work so to enable, rather than constrain, social responsibility (Conlon and Zandvoort, 2011). However, despite its recognition, this need continues to attract comparatively little attention in systems engineering. This suggests that systems development engineers are broadly aware that systems engineering has human and social aspects and implications, but endemic instrumental rationality has focussed their minds and efforts elsewhere. They, in essence, lack the meta-language or framework to think non-instrumentally in order to effectively incorporate social issues, concerns and core human values and empathy into what they do.

In response, the four-factor model presented in this paper provides a framework and meta-language that cogently encapsulates the dominant sentiments in the systems engineering domain. Instrumental rationality emerged cogently and significantly in the model as the Technocentrist/Industriofatalist axis. However, instrumental rationality was found to conflate and hinder the incorporation of substantive human values in systems development. Methodologically, it directs the focus of systems development away from Humanist values and towards more Technocentrist aspects. It also renders Humanist stakeholder interests and rationalities as subservient to Industriofatalist ones. These Industriofatalist interests could be motivated by commercial goals or political realities, for instance, in dictatorial regimes.

The implications of this for international stability are that by adopting a singular Technocentrist/Industriofatalist perspective for systems development internationally, the human values and cultures of those people impacted by such development are being supplanted by a singular and immutable instrumental rationality. However, this mode of rationality may be innately unsuited to the values and environment on which it is being imposed. Furthermore, true rationality is not solely instrumental but rather multifaceted in nature, and incorporates substantive rationality that is innately human-centred (Nozick, 1993). Unless this is recognised, social unrest and instability may result through the imposition of locally incompatible values and systems.

In order to foster international stability, systems development must embrace a more ethically aware and “value sensitive” approach (Friedman, 1996) than that proliferated by the hereunto dominant and instrumentally rational Technocentrist/Industriofatalist axis. The Technocentrist/Industriofatalist axis embodies instrumentally rational sentiments that are often incompatible with Humanist values, and direct Existentialist praxis away from their promotion during systems development. This needs to be redressed by fostering non-instrumental rationalities and by strengthening the Humanist/Existentialist axis to induce greater moral agency in the systems development community. By fostering the Humanist/ Existentialist axis, more professionals may come to value Humanist issues in a way commensurate with their societal importance, and also promote them more actively through Existentialist praxis. This would in turn contribute towards international stability as local cultural and societal values are recognised and actively promoted during technological systems development. Concerns over the level of moral agency individual engineers may enjoy in practice may be addressed by adopting a collective approach in tandem with the individual approach; for instance, through professional bodies, expert groups, charities and non-governmental organisations (Conlon and Zandvoort, 2011, Carew et al., 2011).

Colby and Sullivan (2008) noted that engineering graduates in particular have low levels of commitment to social action, believing that individuals cannot change society. This suggests that engineering education must in the future strive to produce graduates who are more socially-aware (Humanist) and empowered (Existentialist). In other words, the Humanist/Existentialist axis must be fostered over the instrumentally rational and disempowered Technocentrist/Industriofatalist axis. Carew et al. (2011) presented sample evidence that education and training could help induce, promote and sustain the Humanist/Existentialist axis. Interestingly, this position is consistent with calls for an increased role for virtue ethics in systems development (Carew et al., 2008, Grodzinsky, 2000, Gotterbarn, 1999). As previously noted in section 3.4, virtue ethics focuses on the development of personal virtues, that is, characteristics that help induce appropriate moral character and, subsequently, ethical behaviour at the individual level. In the context of the four-factor model outlined in this paper, the Humanist and Existentialist factors could be considered desirable virtues – or classes of virtue – for the systems engineering professional. Their promotion could help instil in individual professionals appropriate moral values (Humanist) and the impetus and courage to act on these in praxis (Existentialist) to help foster human-centred development for international stability. This is in marked contrast to the Technocentrist/Industriofatalist axis that promotes "industrial virtues that may not be virtues in another morality" (cf. Baase, 2009, p.397).

This analysis presented in this paper demonstrated the orthogonal and distinct nature of Technocentrist and Humanist factors in systems development. It also, however, demonstrated the discreteness of Industriofatalist sentiments (which mainly concern organisational and industry issues) to both Technocentrist and Humanist ones. Industriofatalist values, such as economics and efficiency, are therefore not immutably associated with Technocentrist values.

On the contrary, Humanist values and thinking, such as empathy and human-centred development, can also help deliver such values as productivity and efficiency, but in an ethical and socially centred way.

In conclusion, there is a pressing need for systems development practice to embrace and promote the Humanist/Existential axis, which is human-centred and advances Humanist values with Existentialist praxis, over the more instrumental values represented by the Technocentrist/Industriofatalist axis in order to foster international stability. The need for a human-centred approach to systems development for international stability is crucial if we are to deliver systems that are empathic towards the cultural values of the people affected and the environments in which they are to be adopted and used. In order to realise this, there is a need to focus on the macro-ethical culture of engineering as a profession, as opposed to the micro-ethical problems of an individual, in order to enhance human welfare (Conlon and Zandvoort, 2011). This macro-ethical culture could be nurtured through a virtue ethics approach, taking the Humanist and Existentialist sentiments as virtues that may help dispel the sense of individual disempowerment and temper instrumentally rational tendencies with a "spark of human concern" – that is, empathy – for others (Conlon and Zandvoort, 2011, Hoffman, 2001). However, as demonstrated in the analysis presented in this paper, human-centred thinking remains distinct from, and generally deemed less rational than, functionalist/instrumental thinking in systems development. A paradigm shift is therefore required in this regard so human-centred thinking and empathy becomes an integral part of systems development practice in order to foster successful and ethically sensitive systems, which could help foster international stability.

7. Conclusions

In conclusion, this paper has demonstrated that contemporary systems development is not truly human-centred and, consequently, lacks empathy. The analysis revealed dyadic polarisations between human-centred goals and rationalities, and more functionalistic goals and rationalities. It also identified a triadic polarisation in systems development focus regarding individual personal issues, organisational issues, and technical issues. It also illustrated how the human-centred ideal of people-before-organisations-before-technology is not currently being realised in systems development practice. As human-centred systems development could play a pivotal role in fostering international stability, this is a worrying finding, and demonstrates a pressing need for a paradigm shift "towards empathy" in systems development practice.

In order to help induce this paradigm shift, the Humanist/Existentialist axis must be promoted for systems development to help foster durable stability by encouraging personally empowered and responsible Existentialist praxis that is directed towards the protection and advancement of core Humanist values. However, the dominance of the diametric Technocentrist/Industriofatalist axis in promoting amoral, instrumentally rational and industrial/economic values to the detriment of such Humanist values remains a challenge in this regard. Nevertheless, there is a moral imperative on the systems engineering community, and representative organisations and expert groups, to embrace and help promote a more Humanist/Existentialist mode of engineering practice instead of uncritically continuing and propagating the Technocentrist/Industriofatalist approach. Only when there is such a shift towards human-centredness and towards empathy can systems engineering deliver an effective socio-technical system – one that incorporates the values of those affected, and one that fosters a durable stability based on shared human and cultural values.

Note

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