Contents | Author index | Subject index | Search | Home

Searching Usenet for virtual communities of practice: using mixed methods to identify the constructs of Wenger's theory

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Abstract

Introduction. *This research set out to determine whether communities of practice can be entirely Internet-based by formally applying Wenger's theoretical framework to Internet collectives.*
Method. *A model of a virtual community of practice was developed which included the constructs Wenger identified in co-located communities of practice: mutual engagement, shared repertoire, joint enterprise, community and learning or identity-acquisition. The model included additional empirical attributes associated with higher community-of-practice potential: professional topic, high interaction-volume, non-conflictual focused discussions and core-periphery structure. A systematic search of the Usenet discussion network detected eleven news groups displaying these attributes and they were formally tested for the presence of the Wenger constructs.*
Analysis. *A quantitative survey of news group participants and a qualitative content analysis of core-member discussions were applied to select news groups to detect the Wenger constructs, conservatively assessed as present only when both methods concurred.*
Results. *Four online collectives, evenly divided between computer and non-computer topics, were assessed as Usenet-based communities of practice because they exhibited the complete set of Wenger constructs.*
Conclusions. *This provides evidence that extra-organizational communities of practice can emerge spontaneously in the social areas of the Internet, just as they emerge in organizational settings and that true communities of practice are not inherently limited to face-to-face interaction.*

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Introduction

The concept of community of practice originally introduced by Lave and Wenger (1991) and developed extensively in Wenger (1998), has attracted increasing interest in recent years. The Web of Science citation index shows a rising trend of published papers, displayed in Figure 1. Management theorists see communities of practice as a key element in the knowledge-based view of the firm (Kogut and Zander 1996; Brown and Duguid 1998; Tsoukas and Vladimirou 2001; Grover and Davenport 2001), whereas executives recognize them as natural vehicles of knowledge-sharing and innovation and explicitly contemplate them in knowledge management projects (Wenger and Snyder 2000; Saint-Onge and Wallace 2002).
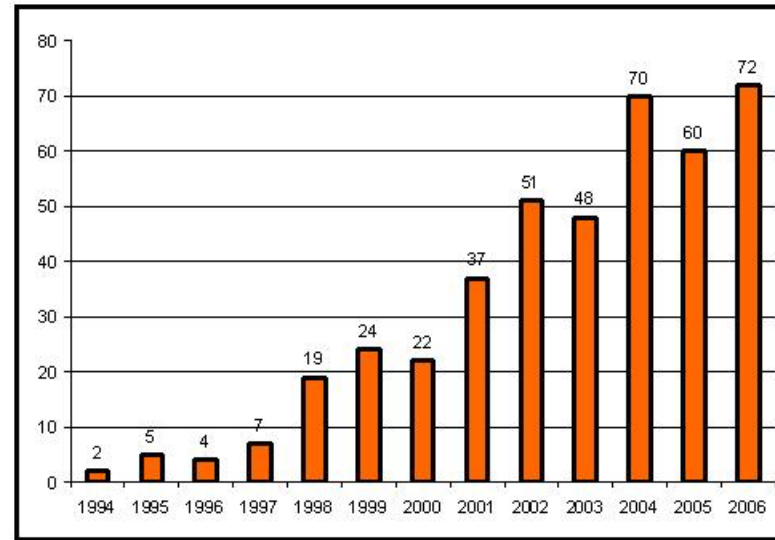
Figure 1: Growth of papers on communities of practice (source, Web of Knowledge)

However, current trends of rapid globalization, networked organizations and mobile workers, are making increasingly rare a condition for conventional communities of practice: stable employee co-location (Holtshouse 1998; Hindle 2006; Kluth 2008). Some consider co-location a necessary condition for the kind of interactions that sustain a community of practice (Brown and Duguid 2000; Wasko and Teigland 2004). On the other hand, there are numerous published accounts of *virtual* communities of practice (e.g., Baym 2000; Robey *et al.* 2000; Saint-Onge and Wallace 2002; Schlager *et al.* 2002; DeSanctis *et al.* 2003; Lee and Cole 2003; Dubé *et al.* 2005). Most of these studies have relied on a condensed definition of community of practice, that either lacks a formal model, or sidesteps Wenger's (1998) theoretical framework without providing a developed alternative. In fact, no study has previously attempted to detect all the constructs in Wenger's theory within Internet-based collectives to establish the existence of virtual communities of practice. This is the aim of this research. It develops a model of virtual community of practice based on Wenger's unabridged theory and uses it to systematically detect and formally assess successful communities of practice operating on a particular area of the Internet known as the Usenet discussion network. The study identified four Usenet communities lacking none of the attributes defined by Wenger for conventional co-located communities of practice and thereby qualifying as Internet-based communities of practice.

Communities of practice and virtual communities of practice

The community of practice concept was introduced in Lave and Wenger's (1991) ethnographic account of traditional apprenticeships and was first applied to an organizational context by Brown and Duguid (1991). Wenger would later publish a book-length ethnography of claims processors at an insurance company (Wenger 1998) where he identifies five constitutive dimensions of communities of practice, specifically:

Mutual engagement (in practice): Wenger considers this the key dimension, because sustained mutual engagement within a group of people will, over time, cause a community of practice to form. Mutual engagement consists of members' practice-related interactions to collaboratively solve problems, produce artefacts and discuss relevant issues.

Joint enterprise: this is the domain of knowledge that brings the community together, gives it an identity and defines the key issues and problems that members need to address.

Shared repertoire: over time, sustained mutual engagement results in the development of a set of communal resources that allow members to more effectively pursue their joint enterprise. These resources include tools, ways of doing things, stories, symbols and artefacts that the community has produced or adopted. In practitioner writings, Wenger uses the terms shared repertoire and practice interchangeably (Wenger *et al.* 2002). More precisely, however, shared repertoire is the instrumental dimension of the community's practice, whereas the

practice itself is the holistic, emergent and indigenous response of the community to the challenge of its joint enterprise (Wenger 1998).

Community: members of a community of practice form a stable group with strong personal interrelationships developed through sustained mutual engagement. Since this engagement may have its origin in an outside mandate (as in the case of the claims processors), friendship and/or affection are neither a requirement nor necessarily a result (Wenger 1998).

Learning or identity acquisition: participating in a community of practice results in members' learning, although not every community makes this an explicit aim. Moreover, Wenger treats learning as equivalent to the acquisition of a new identity, because membership in a community of practice involves identifying with it, becoming an insider.

Wenger's framework is the most developed community of practice theory currently available, arguably the *de facto* standard (Saint-Onge and Wallace 2002; Plaskoff 2003; Thompson 2005), indicated also by a growing number of critiques (e.g., Contu and Willmot 2000; Schwen and Hara 2003; Cox 2005; Roberts 2006). Accordingly, this study will adopt Wenger's framework and operationally define a virtual community of practice as *an Internet-based collective that displays all constitutive dimensions identified by Wenger (1998),* henceforth referred to as the Wenger constructs.

In the context of the information revolution and the knowledge-based organization (Drucker 1988), the concept of community of practice quickly gained popularity. It provided a plausible explanation for the failure of many first-generation knowledge management projects, which relied too heavily on information technology and neglected the social aspects (McDermott 1999; Thompson and Walsham 2004). More specifically, organizational communities of practice are given credit for several positive outcomes, such as fostering knowledge-sharing (Stewart 1996), fostering innovation at all levels (Brown and Duguid 1991), assuming ownership and stewardship of knowledge (Wenger 2004), transferring best practices (Wenger and Snyder 2000) and providing a foundation for core competences (Brown and Grey 1995; Manville and Foote 1996).

Increasing interest in communities of practice led to the popular notion of virtual or Internet-based communities of practice, echoing the finding that communities of various kinds seemed to flourish on the Web (Rheingold 1993; Tepper 1997; Preece 1999). Indeed, the literature of Internet communities (often presented as virtual communities of practice) describes many capabilities displayed by these collectives, which constitute indirect evidence of the viability of the Wenger constructs in an online environment; an overview is provided in Table 1.

Reported capabilities	Wenger constructs
They enable powerful collaboration between widely distributed members (e.g., Robey *et al.* 2000; Kimble *et al.* 2001; Lee and Cole 2003) They enable collective problem-solving (e.g., Wasko and Faraj 2000; Hara and Kling 2002; Lee and Cole 2003) They enable information sharing (e.g., Hara and Kling 2002; Pan and Leidner 2003) They enable sharing of knowledge and best practices (e.g., Lueg 2000; Saint-Onge and Wallace 2002; Wasko and Faraj 2005; Cox 2007; Hara and Hew 2007)	**Mutual engagement**
They can achieve a professional orientation (e.g., Murray 1996; Hara and Kling 2002; Wasko and Faraj 2005; Cox 2007; Hara and Hew 2007) They can maintain focused discussions (e.g., Thomsen 1996; Millen and Dray 2000)	**Joint enterprise**
They can develop knowledge repositories and online tools (e.g., Schlager *et al.* 2002; Ardichvili *et al.* 2003; Pan and Leidner 2003; Bryant, Forte and Bruckman 2005; Hara and Hew 2007)	**Shared repertoire**
They enable formation of stable and persistent virtual communities (e.g., Thomsen 1996; Baym 2000) They enable building strong personal relationships between members who have never met personally (e.g., Teigland 2000; Baym 2000) They are valued by participants as communities of like-minded peers (e.g., Wasko and Teigland 2002;	**Community**

Saint-Onge and Wallace 2002; Hara and Hew 2007)	
They are valued by participants as learning forums (e.g., Murray 1996; Teigland and Wasko 2004; Hara and Hew 2007) They provide a forum for enacting and validating desired professional identities (e.g., Thomsen 1996; Bowers 1997; Teigland 2000; Hara and Hew 2007)	**Learning or identity acquisition**

Table 1: Evidence of Wenger's constructs in the literature of virtual communities

However, the notion of virtual communities of practice faces a theoretical challenge from the related concept of a network of practice, proposed by Brown and Duguid (2000) to explain knowledge leakages between organizations. Where communities of practice are primarily defined by mutual engagement and the strong ties it creates, networks of practice are defined by a practice and the weak ties, direct or indirect, between members of the practice. Since Internet ties are weaker than ties created through face-to-face interaction, researchers who study networks of practice reserve the concept of community of practice for co-located groups and describe practice-focused online communities as electronic networks of practice (Vaast 2004; Wasko and Teigland 2004; Wasko and Faraj 2005; Cox 2007). However, published accounts of networks of practice have not actually explored the feasibility of virtual communities of practice. This is the intended contribution of the model of Usenet-based community of practice described next.

The exemplary virtual community of practice model

The study targets the Usenet discussion network, which was, until the emergence of the blogosphere, the largest discussion area in the Internet (Hahn 2000). The research is guided by the working assumption that there exist stable Usenet groups that function as communities of practice. Were such groups known beforehand, it would be straightforward to rigorously examine them for the presence of the Wenger constructs, but this is not the case. Thus, the first problem is to develop a systematic search strategy capable of detecting online collectives with high community-of-practice potential. This search problem highlighted the need for a model of Usenet-based community of practice that provided a detailed empirical description of the hypothetical online structures the search would target. The finished model would then provide specific guidelines for operationalizing a search and assessment strategy.

This special-purpose model includes two separate sets of hypothesized attributes or traits. The first set, called the *essential traits,* consists of the Wenger constructs. Their presence is considered conclusive evidence of an online community of practice. However, they are difficult to search for directly, because assessing their presence requires qualitative analysis of member interactions, which makes them ill-suited for extensive searches over Usenet. Therefore, the model includes a second set of traits whose task is to amplify, without distortion, the empirical signature of the essential traits in order to facilitate detection of virtual communities of practice. These are called *exemplary traits,* and include several contingent attributes of potential communities of practice that generally make a virtual community more focused, productive and energetic. These attributes cannot by themselves single out a community of practice, because they can be present in all kinds of virtual communities. Yet, they are well suited for extensive Usenet searches because they are highly visible and measurable, thus making detection easier. Moreover, they do not compromise the link to Wenger's framework, because they merely select online collectives exhibiting the highest potential values of the essential traits, without actually modifying them.

With these premises, the exemplary virtual community of practice model is displayed in Figure 2. The essential traits occupy the inner circle and the exemplary traits are arranged in a perimeter, each next to the essential trait it amplifies. The figure emphasizes the contingent role played by the exemplary traits. Given all essential traits, the absence of an exemplary trait does not make an online collective less of a community of practice, but it does make it more difficult to detect. On the other hand, not every collective exhibiting high exemplary trait scores is necessarily a community of practice, for it may lack some essential traits. The model's rationale is that online collectives with high exemplary trait scores are better candidates for a community of practice.
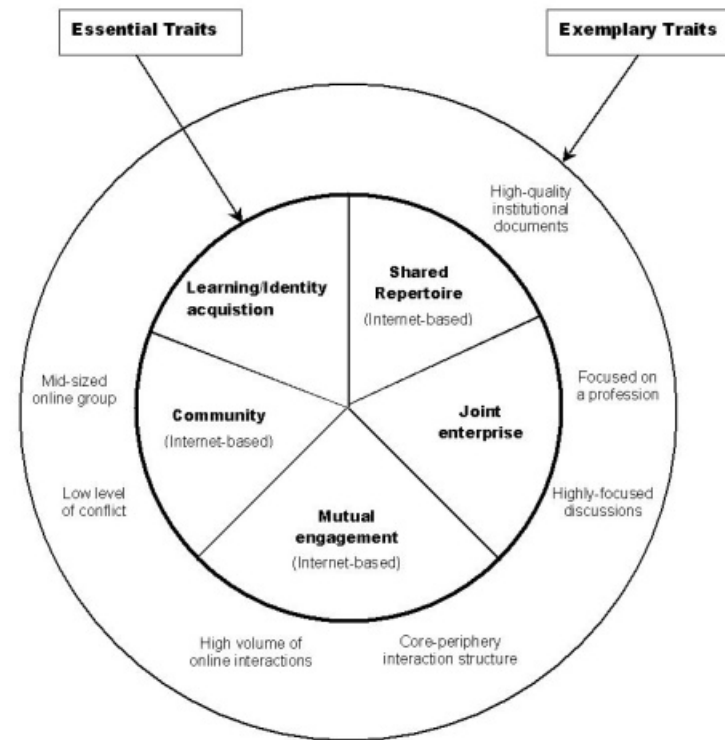
Figure 2: The virtual community of practice model

The essential traits of the model are further specified below, including their hypothesized online manifestations and the exemplary traits associated with each.

Mutual engagement

The possibility of mutual engagement taking place fully over the Internet without substantial loss as compared to co-located engagement brings out the question of the discipline involved. engagement in disciplines that work with text or symbolic languages (such as finance, law, mathematics, philosophy or computer programming) could easily migrate to the text-based Internet environment. By contrast, mutual engagement in disciplines that rely on information that cannot easily be digitized, such as flute making (Cook and Yanow 1993), could not migrate to the Internet without substantial loss. With this caveat, some representative manifestations of successful online mutual engagement would be collaborative problem solving, debating professional issues or sharing domain-related information. Furthermore, the virtual community of practice model links the essential trait of mutual engagement to two exemplary traits: a *high-volume of participant interaction,* since an exemplary virtual community of practice is held to be fairly active as a manifestation of energetic mutual engagement and a *core-periphery structure,* reflecting the potential for various degrees of engagement, which enables active participation of people other than core members (Wenger 1998). This increased membership makes for a more energetic and diverse community. News group core-periphery structures are detected through Borgatti and Everett's (1999) continuous core-periphery model, in which core members are densely tied to each other and periphery members have more ties with core members than with each other.

Shared repertoire

Sustained online mutual engagement will gradually develop a shared online repertoire, i.e., easily accessible tools, routines, knowledge repositories and other instrumental aids to engagement. Representative manifestations include shared online artefacts, shared criteria and shared practices. In addition, the virtual community of practice model links shared repertoire to the exemplary trait of *high-quality institutional documents.* Institutional documents is the name given to useful documents developed by well-organized news groups, such as a charter to tell visitors what the community is about, or a FAQ to avoid needless repetition of routine questions (Kollock and Smith 1996). High-quality documents in an online community are indicative of a capacity for collective action and strong member involvement.

Community

Individuals who directly engage with each other regularly will gradually come to know each other and to coalesce into an engagement-bound community. Representative manifestations include members' knowledge of each other and a shared sense of online community. In addition, the VCoP Model links Community to two exemplary traits. First, an exemplary virtual community of practice is defined as small enough for all members to know and engage with each other, if only through virtual interaction, yet not so small as to stretch the concept of "community". Hence, a *midsized-group*. Second, exemplary virtual communities of practice display a *low level of conflict,* as manifested by Subject headers and message tone. In the Internet social environment, personal conflict can quickly escalate into a full "flame war", which can cause a news group to completely lose its discussion focus (Pfaffenberger 1996).

Joint enterprise

joint enterprise is an elusive construct because it is a mutual understanding, hence largely tacit. Sustained online mutual engagement will gradually negotiate an understanding about what is on-topic and off-topic and members will hold each other accountable to the joint enterprise so defined. A representative manifestation is that the news group cares about an identifiable domain of knowledge. In addition, the VCoP Model links joint enterprise to two exemplary traits. First, to *highly-focused discussions,* which is a general indicator of quality in online communities, that must constantly deal with off-topic messages from non-members and commercial advertisers (Kollock and Smith 1996; Smith 1999). Second, to a *Topic which is an identifiable profession.* Community of practice theory does not restrict joint enterprise to professions; for instance, Lave and Wenger (1991) describe a community of practice of rehabilitated alcoholics. Still, an identifiable profession makes the domain of the news group more visible and narrows the scope of mutual engagement by guaranteeing it is centred on an easily recognizable practice, namely a professional discipline. This is congruent with the mission of the exemplary traits, since a discipline-focused news group intuitively makes a better candidate for a community of practice.

Learning or identity acquisition

Learning or identity acquisition results from sustained online mutual engagement and, like joint enterprise, are tacit, taking place within individuals. Representative manifestations of learning include new knowledge or new skills acquired from online participation. Manifestations of identity are also elusive, since explicit discussion of identity issues in an open news group is not seen often. A representative manifestation is discussion of career issues. No exemplary traits were associated to this essential trait, because none were found that would plausibly amplify it.

The virtual community of practice model is linked to Wenger's theoretical framework through the essential traits. Imposing the additional requirements of the exemplary traits implies reduced generalizability, because they restrict the theoretical range of communities of practice defined solely by the Wenger constructs. Thus, an acknowledged limitation of the virtual community of practice model is that it may well discard *un-exemplary* and yet entirely valid, Usenet-based communities of practice because they lack one or more exemplary traits. In exchange, there are three favourable trade-offs. First, by requiring highly-visible traits that simplify empirical detection, the model enables efficient search and selection of online collectives with higher community-of-practice potential. Second, by enabling extensive searches, the model opens the door to a huge search range, allowing the size and diversity of Usenet to improve the odds of success. Third, detected virtual communities of practice will be of better quality (more *exemplary*) because they will be more focused and energetic.

The *funnel* research strategy

The virtual community of practice model was designed to exploit several advantages that the Usenet network brings to this research. First, Usenet can be efficiently and comprehensively searched using Smith's (1999) news group analysis tool, Netscan (which is no longer available). Several traits of the exemplary set can be quantitatively measured with Netscan and news groups ranked thereby. Second, social network analysis (Wasserman and Faust 1994; Scott 2000) can be applied to Usenet news groups to reveal cohesive subgroups of online participants and core-periphery structures (Murillo 2002). In particular, a core-periphery model can be fitted to individual news groups, thus measuring another exemplary trait. Third, Usenet is big. Prior to the emergence of the blogosphere, Usenet was the largest and oldest discussion network on Earth (Hahn 2000). While size makes the search more challenging, it is also a resource, because large numbers of heterogeneous participants improve the odds of achieving collective action. Oliver and Marwell's (1988) theory of critical mass predicts that large networks are more likely to succeed in collective action because they have a better chance of containing a number of dedicated and competent *organizers* who can band together and mobilise others. Finally, Usenet represents an interesting limit case given its low media-richness. If complex mutual engagement can be effectively sustained within the limitations of plain-text messages, giving rise to extra-organizational Usenet communities of practice, then it should be easier to achieve in the rich media afforded by modern intra-organizational networks (Daft and Lengel 1986).

Implicit in the virtual community of practice model is a two-stage research strategy. Stage One relies on the exemplary traits to

systematically search Usenet and identify a narrow subset of news groups with high exemplary trait scores, hence high community-of-practice potential. Stage Two relies on the essential traits to rigorously assess the presence of the Wenger constructs in selected news groups.

Each stage deploys research methods tailored to the task. Stage One uses Netscan for extensive Usenet searches, followed by visual inspection of news groups' institutional documents and discussion focus and lastly fits a core-periphery model to surviving news groups. Stage Two performs the community of practice assessment by using mixed methods (Yauch and Steudel 2003; Johnson and Onwuegbuzie 2004). A quantitative survey questions news group participants about visible manifestations of the Wenger constructs. This is complemented by a qualitative content analysis of textual discussions between core-members, again targeting the Wenger constructs. Both methods contribute equally to a composite assessment of the essential traits. Specifically, the test requires concurring results from both instruments, as illustrated in Figure 3. This triangulation design has two advantages (Rocco *et al.* 2003). First, making the assessment more rigorous reduces the field of candidates, but increases confidence in the validity of results. Secondly, the use of two independent instruments builds a more complete picture of participating collectives than either method could achieve separately.
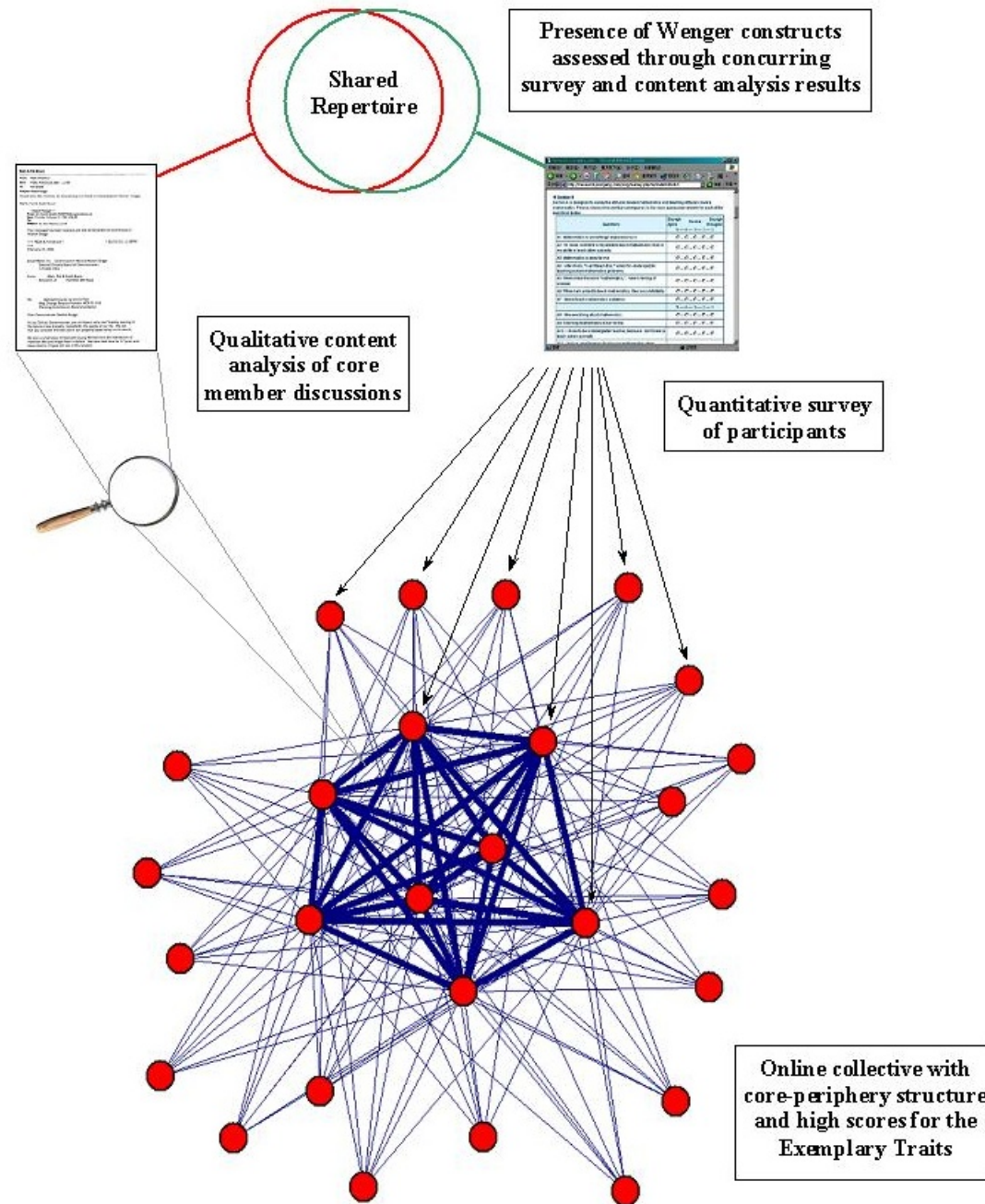
Figure 3: Multi-method assessment of virtual community of practice

This research strategy can be visually represented as a funnel, as shown in Figure 4. Its logic involves taking in as many news groups as possible in Stage One and making the first selection through the quantitative criteria of the exemplary traits. This results in a considerably reduced news group subset, which can then be examined through direct observation, using the qualitative criteria of the exemplary traits; a

more time-intensive method. This again results in a substantial narrowing of eligible news groups, which then go through the computationally intensive core-periphery analysis. news groups displaying the highest exemplary trait scores then proceed to Stage Two, where the essential traits come into play. Two methods independently test for the presence of the Wenger constructs, the survey of news group participants and the content analysis of core-member discussions. Concurring results are interpreted as conclusive evidence for each essential trait. The study hypothesises that at least some news groups will demonstrate possession of all essential and exemplary traits and qualify as exemplary Usenet-based communities of practice. The logic of the funnel design favours more extensive methods near the top (notably, Netscan) and more intensive methods near the bottom (notably, the content analysis). This reconciles a fairly comprehensive Usenet search with more intensive assessment methods.
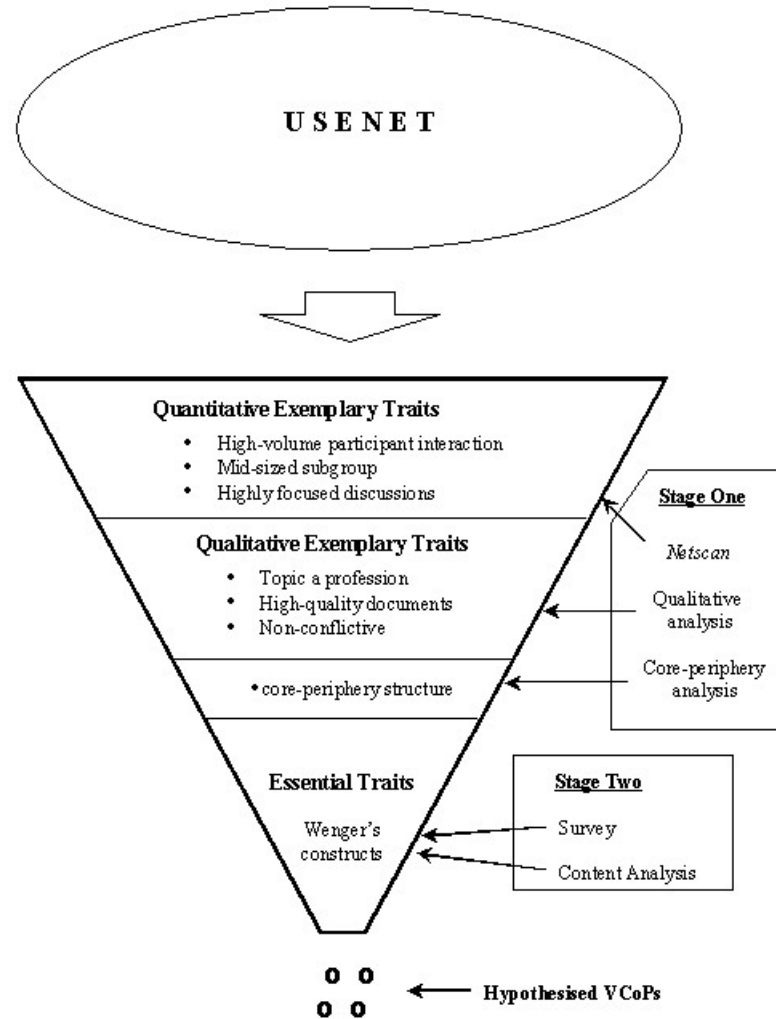

Figure 4: Research strategy for the evaluation of virtual communities of practice

Once the virtual community of practice model and its associated research strategy were fully drawn up, the field research was launched with an extensive search of Usenet, described next.

Usenet search and selection of participating news groups

Usenet news groups are grouped into topical hierarchies (comp.* for computer topics, sci.* for science, etc.) and Netscan can only search one hierarchy at a time. To make the search as comprehensive as possible, while choosing a theoretically relevant sample, the study targeted the mainstream hierarchies, which hold the longest-running and best-established subset of news groups in Usenet (Hahn 2000). Three of these hierarchies, rec.*, news.* and talk.*, can be safely discarded from the study, because their topics are generally incompatible with the exemplary trait criterion of a professional topic.

The alt.* hierarchy deserves a mention. Although it is the largest, it is regarded as rather more frivolous than the mainstream (Bradley 1999). Anyone can launch an alt news group for the most trivial or humorous discussion topics (such as alt.swedish.chef.bork.bork.bork or alt.barney.die.die.die). Therefore, this hierarchy was discarded, with the considered exception of the alt.comp.* sub-hierarchy, which is known to contain many competent computer news groups.

Two more hierarchies were included, the Canadian news groups, can.* and the British news groups, uk.*. They are the largest English-language hierarchies after the USA news groups, hence interesting search areas.

The seven selected hierarchies, listed in the first column of Table 2, are the most plausible Usenet areas for seeking *professional* news groups, the *best neighbourhoods*, as it were. The fact that they merely include 2,842 news groups must be put in context. Even though Usenet contains over 100,000 news groups, the majority are inactive for lack of participants (Smith 1999, 2002). Hahn (2000) puts the number of active news groups enjoying worldwide circulation at 7,500, not counting so-called organizational hierarchies started by companies or universities. Therefore, it is not surprising that when popular hierarchies, such as alt.* and rec.*, are discarded, the potential search area for professional news groups becomes much smaller.

Next, the quantitative and qualitative criteria of the exemplary traits were operationalized as funnel filters, based on four interaction measures reported by Netscan for each news group: the number of messages posted each month (Posts), the number of authors who posted on the current and previous month (Returnees), the ratio of posters to posts (PPRatio) and the proportion of messages that were posted to more than one news group (%CrossPost). Table 2 displays exemplary traits, filter definitions and the effect each filter had on selected hierarchies comprising an initial population of 2,842 news groups. The filtering resulted in nineteen news groups being targeted for core-periphery analysis.

Hierarchies	sci.*	misc.*	comp.*	soc.*	uk.*	alt.comp.*	can.*	T
Number of newsgroups	243	272	1196	310	462	255	104	2
Filter1: 10 ≤ Returnees ≤ 200	110	87	409	152	248	64	17	1
Filter2: Posts ≥ 300	59	44	220	115	152	31	11	
Filter3: PPRatio + %CrossPost ≤ 0.40	12	14	88	36	76	8	3	
Filter4: English-language newsgroups	10	14	88	32	76	8	3	
Filter5: Topic an identifiable profession	8	8	17	4	3	1	0	
Filter6: High-quality institutional documents	3	3	9	4	2	0	0	
Filter7: No flames	3	3	8	3	2	0	0	

Table 2: Initial newsgroup population and application of Exemplary Trait criteria

After completing downloads of a full year of news group activity, messages were imported into a database to derive the social network formed by members' postings to each other. This extended observation period renders non-random social networks more visible, particularly core-periphery patterns (Murillo 2002). For instance, the core-periphery interaction pattern of news group sci.med.transcription clearly stands out in a plot of messages exchanged between the eighty most active members during a one-year period (Figure 5).
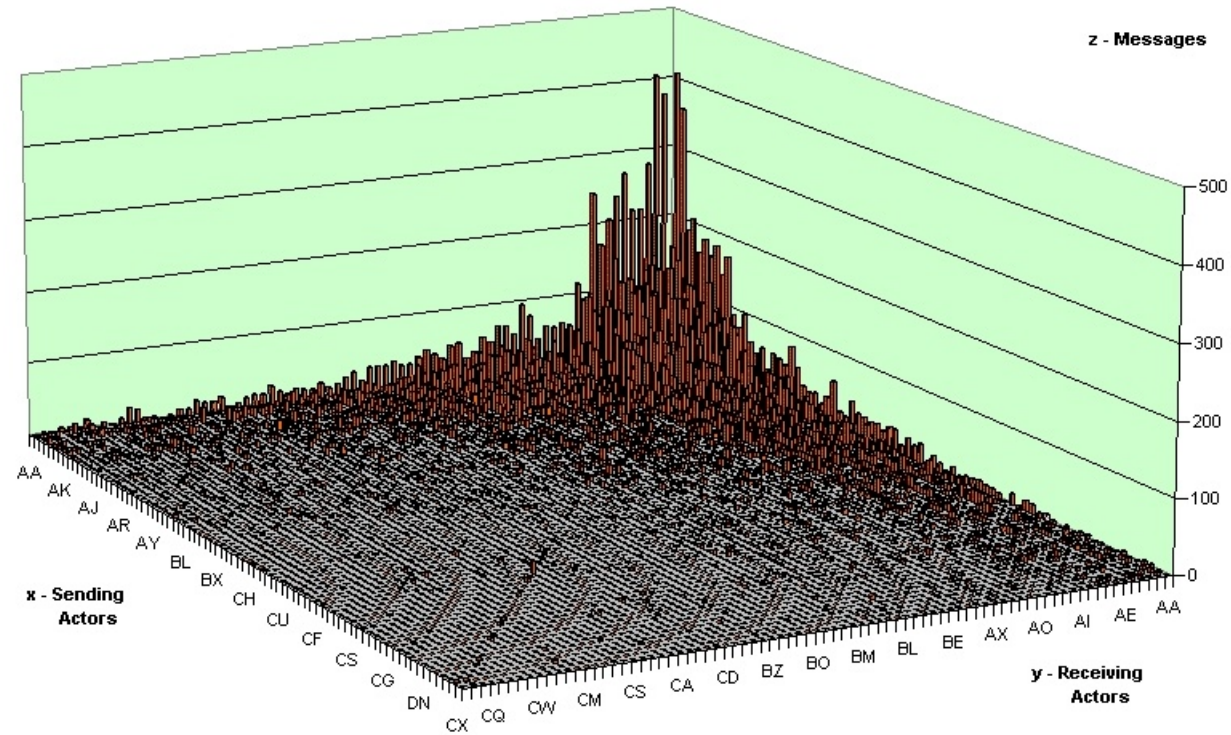
Figure 5: Plot of messages in the *sci.med.transcription* news group

A continuous core-periphery model was fitted to these nineteen news groups using UCINET (Borgatti *et al.* 2002). Model fit was assessed using correlation and plotted concentration values. Three news groups exhibited poor model fit and were discarded. Avoiding too-similar news groups (such as comp.lang.c++.moderated and comp.std.c++) and preserving a balance of information technology and non-information technology topics, a final sample of twelve news groups was selected as the output of Stage One. These news groups display high scores for each of the exemplary traits (see Table 3), which makes them strong candidates for a community of practice. Yet, this is as far as Stage One can go; evaluating the presence of the essential traits corresponds to the methods of Stage Two, the survey and content analysis, addressed next.

News group	Identifiable Profession	Netscan statistics				Institutional documents				Core-periphery mo		
		Returnees	Posts	PPRatio	%CrossPost	Charter	FAQ	Posting guidelines	Home page	Assessment	Correlation	Concer
ADA	Programming	95	1112	0.19	0.03	•	•		•	Very good	0.73	0.
COBOL	Programming	77	1913	0.09	0.01	•	•	•		Good	0.86	0.
CPLUS	Programming	172	1718	0.25	0.05	•	•	•	•	Very good	0.75	0.
CRYPT	Cryptography	129	1798	0.20	0.08		•	•		Very good	0.81	0.
VISOBJ	Programming	163	2093	0.14	0.01	•	•			Good	0.89	0.
XTRPRG	Programming	31	493	0.21	0.11		•		•	Good	0.76	0.
CIVWAR	History	47	439	0.25	0.02	•	•	•	•	Very good	0.66	0.
FINPLAN	Financial planning	42	387	0.31	0.00	•	•	•	•	Good	0.75	0.
MEDTRAN	Medical transcription	87	5054	0.03	0.00	•	•	•		Good	0.94	0.

PHYSRES	Theoretical Physics	107	963	0.25	0.15	•	•	•	•	Very good	0.71	0.
TAXES	Tax preparation	162	2006	0.24	0.00	•	•	•	•	Very good	0.71	0.
UKAGRI	Farming	66	2267	0.07	0.06	•	•			Good	0.92	0.

Table 3: Measured affinity of selected news groups to exemplary traits of the virtual community of practice model

Survey of news group participants

The construction of the survey followed the guidelines suggested by DeVellis (2003) and focused on the hypothesized manifestations of the essential traits that comprised twelve visible sub-constructs or indicators (see Table 4). A review of published scales (Rubin *et al.* 1994) did not find any that fit these novel constructs and sub-constructs. The author iteratively developed and refined a 214-item bank; sixty were selected for the pilot questionnaire, with five-item scales for each sub-construct. The items were also submitted to the review of a subject expert. The survey also included an open question asking participants if they thought their news group was a community and why.

essential trait	Hypothesized sub-constructs or indicators
Learning or identity acquisition	Acquiring new knowledge Acquiring new skills Acquiring and enacting a professional identity
Mutual engagement	Debating issues related to the profession Collective problem-solving Sharing useful information
Shared repertoire	Shared criteria shared practices shared artefacts
Community	Members' knowledge of each other Shared sense of community
Joint enterprise	Caring for some domain of knowledge

Table 4: Hypothesized manifestations of the essential traits

To maximize convenience to invited participants, a Web-based survey was used, with point-and-click Likert scales that respondents could fill in quickly and accurately (Witmer *et al.* 1999). The survey underwent two pilots: the first on news group ADA, the second on PHYSRES. Reliability analysis on the first pilot resulted in wording changes in twenty-one items. The second pilot resulted in discarding three items, but otherwise no changes; hence its results were retained as valid responses.

For the sake of layout clarity, the survey is organized into four thematic blocks, each containing three related sub-constructs. Items within each block were randomized. The final survey is provided in Appendix 1.

Invitations to take the Web-based survey were e-mailed to 1,392 valid addresses obtained from news group messages. One-time posters were not invited; the survey targeted participants who displayed a minimum stability over the one-year period of the sample. With 239 usable surveys received, the overall response rate was 17.2% consistent with other Internet surveys (Witmer *et al.* 1999). Descriptive statistics for the sample are displayed in Table 5.

	n	Percent
Sex		
Male	209	87.4
Female	30	12.6

Missing	0	0.0
Age		
< 36	75	31.4
≥ 36 and < 50	87	36.4
≥ 50	71	29.7
Missing	6	2.5
Tenure in news group (in months)		
≤ 24	64	26.9
≥ 25 and ≤ 48	79	33.1
≥ 49	94	39.3
Missing	2	0.8
Coreness		
≥ 0.001 and < 0.005	50	20.9
≥ 0.005 and < 0.010	41	17.2
≥ 0.010 and < 0.050	85	35.6
≥ 0.050 and < 0.100	22	9.2
≥ 0.100	30	12.5
Missing	11	4.6

Table 5: Descriptive statistics of survey sample (n =239)

The results of the hypothesized scales underwent reliability analysis and Exploratory Factor Analysis, with separate analysis of each of the four thematic item-blocks, in effect treating each as a separate three-scale questionnaire. Each factor analysis used unweighted least squares, with the number of factors recommended by Horn's parallel analysis (Zwick and Velicer 1986) and Promax rotation with k = 4 (Tataryn et al. 1999). The criterion of salient loading was set at 0.4. Once simple structure was achieved, latent constructs were identified and a reliability analysis performed on the resulting scales.

The results confirmed most hypothesized scales. Six latent constructs matched the hypothesized scales for collective problem-solving, debating domain-related issues, shared criteria, members' knowledge of each other, acquiring new knowledge and shared practices. Three other latent constructs had no immediate counterpart among the hypothesized scales. Examination of items loading under each led to their being identified as *improving professional skill*, *identifying with the profession* and *shared sense of professional community*. Each of these new scales describes theoretically consistent manifestations of one and only one of the Wenger constructs. Hence, they can be integrated in the validated questionnaire as new indicators or sub-constructs (DeVaus 2002). Indeed, they are conceptually very similar to the original sub-constructs. For instance, *identifying with the profession* is similar to *acquiring and enacting a professional identity*. Thus the nine validated scales can be conceptually linked to four of the Wenger constructs as displayed in Figure 6.
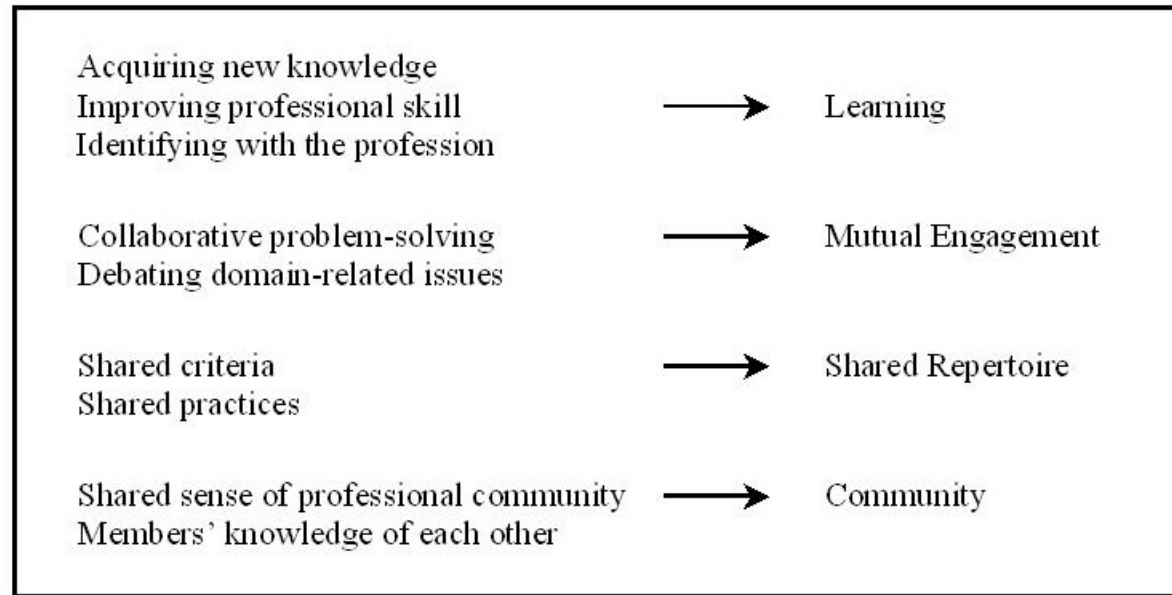
Figure 6: Factor-analysis-validated scales and the Wenger constructs

The fifth construct, joint enterprise, remains unmeasured because none of the validated scales could be logically connected to the hypothesized indicator of *Caring for a domain of knowledge*. Hence, the validated questionnaire has this *blind spot*, as it were. This limitation was addressed by seeking evidence of joint enterprise in the textual responses to the open community question.

Descriptive statistics of the validated scales are displayed in Table 6; simple summated scales were used to calculate scores (Gorsuch 1983). The table also presents the labels assigned to the variables.

Item-block	Validated scale	Label	Items	n	Mean	*s.d.*	Cronbach alpha
learning / identity acquisition	Improving professional skill	Skill	5	234	3.34	0.81	0.87
	Acquiring new knowledge	Know	3	235	4.31	0.58	0.80
	Identifying with the profession	Ident	4	235	3.59	0.77	0.76
mutual engagement	Collective problem-solving	ProbSolv	5	234	3.34	0.81	0.87
	Debating domain-related issues	Debate	3	235	4.31	0.58	0.80
shared repertoire	shared criteria	ShCrit	5	234	3.34	0.81	0.87
	shared practices	ShPrac	3	235	4.31	0.58	0.80
Community	shared sense of professional community	ProfComm	5	234	3.34	0.81	0.87
	Members' knowledge of each other	MemKnow	3	235	4.31	0.58	0.80

Table 6: Descriptive statistics of validated scales

To test for the presence of the sub-constructs, variables were evaluated at the news group level and two-tailed t-tests were performed comparing mean scale scores to the mid-point of the Likert scale (i.e., 3.0), using a Bonferroni correction to assure an overall 95% significance level (SPSS 1997). Results are displayed in Table 7, with significantly high scores highlighted in bold. News groups have been ordered by number of significant scores. Statistical evidence of the presence of a sub-construct in a particular community will be

interpreted as evidence of the presence of the corresponding construct, as previously mapped in Figure 6.

		Know	Skill	Ident	ProbSolv	Debate	ShCrit	ShPrac	ProfComm	
CPLUS	*n*	33	33	33	32	33	33	33	33	
	Mean	4.38	3.60	3.84	3.60	3.93	3.44	3.83	3.90	
	s.d.	0.55	0.76	0.63	0.74	0.72	0.62	0.43	0.43	
	t-score	**14.36**	**4.54**	**7.66**	**4.58**	**7.41**	**4.10**	**11.21**	**12.05**	
	2-tail sig.	**0.000**	**0.016**	**0.000**	**0.000**	**0.000**	**0.002**	**0.000**	**0.000**	
TAXES	*n*	30	30	30	30	30	30	30	30	
	Mean	4.56	3.69	3.93	4.05	4.01	3.73	3.27	4.16	
	s.d.	0.43	0.58	0.63	0.58	0.48	0.70	0.47	0.43	
	t-score	**19.73**	**6.44**	**8.04**	**9.95**	**11.65**	**5.72**	**3.12**	**14.69**	
	2-tail sig.	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.037**	**0.000**	
MEDTRAN	*n*	16	16	16	16	16	16	16	16	
	Mean	4.40	3.73	3.95	4.05	4.04	3.39	3.39	4.10	
	s.d.	0.66	0.89	0.63	0.66	0.61	0.71	0.38	0.56	
	t-score	**8.49**	**3.25**	**6.08**	**6.41**	**6.86**	2.17	**4.16**	**7.92**	
	2-tail sig.	**0.000**	**0.047**	**0.000**	**0.000**	**0.000**	0.414	**0.008**	**0.000**	
VISOBJ	*n*	19	19	19	19	19	19	19	18	
	Mean	4.61	3.86	4.13	4.00	3.84	3.40	3.78	4.16	
	s.d.	0.42	0.64	0.57	0.49	0.60	0.61	0.58	0.51	
	t-score	**16.77**	**5.85**	**8.60**	**8.98**	**6.10**	2.84	**5.81**	**9.58**	
	2-tail sig.	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	0.098	**0.000**	**0.000**	
PHYSRES	*n*	38	37	38	38	38	37	37	37	
	Mean	4.38	3.09	3.39	3.10	3.80	3.03	3.28	3.63	
	s.d.	0.56	0.70	0.55	0.78	0.67	0.88	0.56	0.67	
	t-score	**10.43**	0.25	**3.06**	0.43	**5.97**	0.40	**3.18**	**5.65**	
	2-tail sig.	**0.000**	1.000	**0.036**	1.000	**0.000**	1.000	**0.027**	**0.000**	
UKAGRI	*n*	14	14	14	14	14	14	14	14	
	Mean	4.00	3.04	3.36	4.20	3.38	3.23	3.04	4.12	
	s.d.	0.39	0.70	1.00	0.52	0.75	0.87	0.75	0.51	
	t-score	**9.54**	0.23	1.33	**8.63**	**4.42**	0.99	0.18	**8.17**	
	2-tail sig.	**0.000**	1.000	0.874	**0.000**	**0.006**	0.977	1.000	**0.000**	
COBOL	*n*	24	24	24	24	24	24	24	24	
	Mean	4.04	3.12	3.77	3.55	3.43	2.93	3.29	3.96	
	s.d.	0.70	0.71	0.58	0.89	0.61	1.00	0.56	0.57	
	t-score	**7.25**	0.81	**6.51**	3.02	**3.46**	-0.33	2.57	**8.31**	
	2-tail sig.	**0.000**	0.994	**0.000**	0.055	**0.019**	1.000	0.152	**0.000**	
	n	15	15	15	15	15	15	15	15	

XTRPRG	Mean	4.20	3.39	3.57	3.13	4.00	2.75	3.85	3.31
	s.d.	0.73	1.05	0.95	0.96	0.49	0.99	0.60	0.68
	t-score	**3.75**	1.24	1.45	0.00	**5.70**	-1.05	**4.59**	1.75
	2-tail sig.	**0.018**	0.909	0.809	1.000	**0.000**	0.965	**0.003**	0.612
CRYPT	n	17	17	17	17	17	17	17	16
	Mean	4.22	3.40	3.46	3.08	3.55	2.92	3.47	3.58
	s.d.	0.53	0.68	0.53	0.81	0.84	1.10	0.65	0.72
	t-score	**9.52**	2.43	**3.53**	0.42	2.69	-0.31	2.99	**3.25**
	2-tail sig.	**0.000**	0.219	**0.025**	1.000	0.145	1.000	0.078	**0.048**
CIVWAR	n	18	18	18	18	18	19	19	19
	Mean	4.26	2.83	2.71	2.92	3.44	2.71	2.74	3.39
	s.d.	0.54	0.60	0.74	0.64	0.91	0.88	0.54	0.60
	t-score	**5.18**	-1.60	-2.03	-1.02	2.07	-1.81	-2.39	1.98
	2-tail sig.	**0.000**	0.707	0.414	0.970	0.390	0.554	0.223	0.441
FINPLAN	n	11	11	11	11	11	11	11	11
	Mean	3.91	2.47	2.68	3.05	3.45	2.62	2.66	3.26
	s.d.	0.40	0.90	0.57	0.54	0.64	0.88	0.87	0.65
	t-score	**7.60**	-1.94	-1.85	0.33	2.37	-1.44	-1.30	1.32
	2-tail sig.	**0.000**	0.531	0.590	1.000	0.305	0.832	0.895	0.888

Table 7: news group-level scores for sub-construct variables

The last item in the questionnaire was an open question: "Do you consider this news group a community and why?" The first result from the community question was a clear yes/no opinion on whether each news group is a community; results are displayed in Table 8. In nine out of eleven news groups, more than 50% of respondents judged either the news group or a subset of it to be a community. The two exceptions were FINPLAN, with only 44% of respondents answering in that sense and CIVWAR, with only 38%. The two news groups scoring highest on the community question were MEDTRAN and UKAGRI, with 86% and 82% respectively.

news group	Number of responses	"Yes"	"Only core or regulars"	"No"	Uncommited
CPLUS	28	64%	11%	11%	14%
VISOBJ	17	71%	0%	0%	29%
COBOL	21	62%	5%	10%	24%
XTRPRG	16	38%	12%	25%	25%
FINPLAN	9	22%	22%	44%	11%
TAXES	27	56%	15%	7%	22%
CRYPT	15	73%	0%	20%	7%
MEDTRAN	15	73%	13%	0%	13%
PHYSRES	23	52%	9%	17%	22%
CIVWAR	16	25%	13%	31%	31%

	UKAGRI	11	55%	27%	0%	18%

Table 8: Responses to the question Do you consider this news group to be a community?

Many participants completed their yes/no opinion with elaborate explanations, which provide a wealth of additional information about the news groups. These responses were coded using the same coding scheme developed for the content analysis and described in the next section. Code counts for the indicators of Community and joint enterprise are displayed in Table 9. Since relying on a single response to indicate the presence of a sub-construct would be risky, a minimum of three separate respondents was required to consider reported evidence about a sub-construct as relevant. This is recorded in Table 9 by highlighting in bold type construct code counts of three or more.

news group	Number of responses	Members' knowledge of each other	shared sense of community	Caring for a domain of knowledge
CPLUS	28	**4**	0	**10**
VISOBJ	17	**3**	0	**4**
COBOL	21	2	1	2
XTRPRG	16	**4**	0	**7**
FINPLAN	9	0	0	1
TAXES	27	**4**	**5**	**6**
CRYPT	15	2	0	0
MEDTRAN	15	**4**	1	0
PHYSRES	23	**5**	0	**4**
CIVWAR	16	1	1	**6**
UKAGRI	11	**3**	1	0

Table 9: Content analysis of textual responses to community question

Being the direct focus of the open question, it came as no surprise that the coding exercise found evidence of Community in all but three news groups: FINPLAN, CIVWAR and CRYPT. The evidence consisted of participants reporting members of the news group knew each other and/or participants reporting they perceived a shared sense of community.

The coding exercise also found evidence of 'Caring for a domain of knowledge', which is the hypothesized indicator for joint enterprise. This consisted mostly of participants reporting a strong topical focus in news group discussions and/or strong participant interest or expertise in the topic. Code counts for this sub-construct were below three for five news groups (CRYPT, MEDTRAN, COBOL, FINPLAN and UKAGRI), all the rest had four or more instances.

The content analysis of the community question thus found evidence of Community and joint enterprise that fell outside the scope of the validated scales. Although this evidence is not statistical, it seems fairly relevant. In addition to a conservative minimum of three respondents attesting to the presence of a sub-construct, the majority of responses (79%) came from participants with a tenure of two years or more, which would indicate a reasonably good "feel" for the culture of the various virtual communities. Therefore, respondent testimony regarding these three sub-constructs will be reported separately and used as a complement for scale results.

Content analysis of core-member interactions

Like the survey, the content analysis was designed to detect the essential traits of the virtual community of practice model, only this time by direct qualitative analysis of messages exchanged between core members of each community. The working hypothesis is that selected

news groups are true communities of practice. Hence, interactions, which take the form of exchanged messages, should manifest the Wenger constructs. The hypothesized coding scheme will therefore use the same indicators previously used in the survey (see Table 3), albeit with working definitions suited to the task. The coding was carried out with the help of Nudist 6.0, qualitative analysis software. Codes were developed and piloted using the procedure suggested by Miles and Huberman (1994) for pre-defined or *a priori* codes.

The unit of analysis is the individual Usenet message; the coding exercise will make a theory-informed assessment of whether the textual content of each message yields evidence of any of the sub-constructs. Messages generally admit more than one code, not just because they are fairly long, but also because codes are not mutually exclusive (the same textual passage, for instance, can yield evidence of mutual engagement and shared repertoire, since the latter is instrumental to the former). Though using pre-defined codes, the content analysis is qualitative, because it will focus on the presence or absence of the essential traits in specific textual passages, rather than how many times they manifest themselves. Thus, it is not based on a count of pre-defined keywords, as with some quantitative versions of content analysis (Neuendorf 2002), but on the application of Wenger's theoretical framework to textual passages recording interactions of online communities. Nevertheless, a summary of code counts will be provided, because it is a useful reference even in a qualitative context (Miles and Huberman 1994; Silverman 2000).

Complete threads were used as the sampling units for the Content Analysis. The advantage of threads over individual messages lies in the former representing a complete and coherent online discussion. Thus a complete thread is easier to interpret and analyse because the various messages provide a context and oftentimes a critical review of each other.

With eleven participating communities and a one-year message sample from each, an exhaustive content analysis is not possible; therefore, a theoretical sample of four "exemplary" threads was drawn from each community. Theory suggested aiming at threads that showed community members fully engaged in their online 'work', as they would potentially afford the clearest manifestations of the essential traits. To this effect, the following criteria were set for sample selection:

Criterion 1: An *exemplary* thread addresses a professional topic.
Criterion 2: An *exemplary* thread is longer than average.
Criterion 3: An *exemplary* thread involves mostly interactions between core members.

The first criterion ensures that eligible threads are focused on the professional domain of the community. The second privileges longer online threads (i.e., eleven or more messages), where there is a greater chance of the essential traits (particularly mutual engagement) playing themselves out. The third criterion privileges threads dominated by core members (with coreness of 0.10 or better) who are, because of their intensive mutual engagement, the most representative members of the hypothesized communities of practice.

Because all threads were imported into a database to perform the social network analysis, it is easy to sort them by compliance with these criteria and then simply choose the top four threads from each news group. This sampling procedure is theoretically grounded and places a limit on subjective author preferences, thus reducing the risk of anecdotalism (Silverman 2000). An overview of the forty-four sampled threads is displayed in Table 10.

Thread ID	Number of messages	% Posted by core members	Thread title
CIVWAR1	69	81%	Great Slave Roundup
CIVWAR2	18	67%	A couple more fond slave memories
CIVWAR3	31	81%	Copied Into The Constitution
CIVWAR4	11	64%	Best of The Civil War Group was Slaves liking their Masters
COBOL1	69	81%	Where did you get this? (was: COBOL/DIALOGUE System)
COBOL2	18	67%	Style (was: Sets and subsets)
COBOL3	31	81%	Combat programming (was Alphabets)
COBOL4	11	64%	Symbols vs Words
CPLUS1	69	81%	Status of new libraries, was: Re: Using policy-based smart pointers, part 1

CPLUS2	18	67%	Unnamed namespaces
CPLUS3	31	81%	reading input
CPLUS4	11	64%	Using policy-based smart pointers, part 1
CRYPT1	69	81%	Xoring sequences
CRYPT2	18	67%	Why is Mok-Kong Shen Here? (Was: Re: Turing: fast stream cipher)
CRYPT3	31	81%	open problem in cryptanalysis
CRYPT4	11	64%	Boolean Decomposition for Cryptographers
FINPLAN1	69	81%	Which bond fund???
FINPLAN2	18	67%	Immediate Annuity with a COLA (was: I want to retire early, help!)
FINPLAN3	31	81%	Self-employed health insurance deduction
FINPLAN4	11	64%	term life insurance is cheap
MEDTRAN1	69	81%	Yeeee-hah!
MEDTRAN2	18	67%	foot pedal question
MEDTRAN3	31	81%	Bambi - Precyse
MEDTRAN4	11	64%	Digital Transcription
PHYSRES1	69	81%	Stern Gerlach and spinning ball electrons
PHYSRES2	18	67%	When is collapse physical? (was: Everett ...)
PHYSRES3	31	81%	Gravity from Weitzenboeck
PHYSRES4	11	64%	density matrix = knowledge about the system?
TAXES1	69	81%	Section 121 and Depreciation Allowed or Allowable
TAXES2	18	67%	Do tax preparers require receipts for small donations of
TAXES3	31	81%	Office in Home
TAXES4	11	64%	Currently deductible new roof for rental property
UKAGRI1	69	81%	Manganese sulphate
UKAGRI2	18	67%	Bin thermometers
UKAGRI3	31	81%	cow parsley/Queen Anne's Lace was Re: Where have all the swallows gone?
UKAGRI4	11	64%	Sugar Beet
VISOBJ1	69	81%	5333 with DBorderCreate / VOPP
VISOBJ2	18	67%	DBServer:Total bug (another one) in case there are Memo fields?
VISOBJ3	31	81%	Another bBrowser Question
VISOBJ4	11	64%	XP HOME
XTRPRG1	69	81%	Evaluating the socio-political issues surrounding XP
XTRPRG2	18	67%	Don't interrupt (Pair Programming advice)

XTRPRG3	31	81%	What is wrong with pushing it to the limit
XTRPRG4	11	64%	Doin XP

Table 10: Descriptive statistics of sampled threads

The thread sample comprised more than 320,000 words, a substantial textual corpus, which was imported into Nudist to undergo a two-pass coding procedure; text-wise and code-wise. The first pass involved focusing on a single news group at a time and reading and coding each thread and message in its natural sequence, so as to become familiarized with the discourse, issues and personalities of each news group. A useful aid was the complete news group archive, which could be browsed or searched using the Agent newsreader software, which held the original news group data. For instance, this proved a good way to search for the meaning of domain-specific acronyms. Also useful was the multi-panel interface of Agent, because it gave a bird's-eye view of the original multi-message thread, making it easier to follow the sequence of a threaded discussion that could get lost in the more confined Nudist message display.

The second pass involved a systematic process of code review (Miles and Huberman 1994), which relied on the powerful capability of Nudist to browse through codes themselves, i.e., through all textual passages similarly coded. Thus, the second round of coding involved reading the entire textual sample again, this time code-wise, with the deliberate aim of improving coding consistency. Reading each code across the eleven different news groups resulted in multiple revisions of previously coded text-units. Most notably, the pervasive *shared artefacts* code was broken down into five narrower, mutually exclusive sub-codes, specifically:

- Symbolic language (computer code, mathematical equations, tables, spreadsheets, etc.)
- Usenet artefacts (posting guidelines, FAQs, moderator notes, news group archives, etc.)
- Cites (citations from accepted references, such as laws, historical sources, etc.)
- Specialized tools (specialized hardware, software, trade magazines, etc.)
- Jargon (domain-specific technical language, acronyms, etc.)

At the end of the second pass, with no messages left uncoded, nearly all 1,497 messages in the sample were meaningfully coded by the hypothesized codes. Only forty-five messages (3%) were coded by the *Other* category, which was organized into four auxiliary codes. Overall, the explanatory power of the hypothesized codes was excellent. As an outside check on coding decisions, a large random sample of coded threads was independently reviewed by a subject expert, who pronounced the coding to be sound. A sample of coded passages from news group TAXES is provided in Appendix 2 (the complete Nudist data files are available from the author).

A quantitative summary of results is displayed in Table 11. Sub-construct codes are only counted once per message, irrespective of whether one or several textual passages within the message provide evidence for it. For instance, Table 8 shows the code 'Symbolic language' has a count of 24 instances in the CPLUS news group. This means that, within the CPLUS sample, visible episodes of symbolic language appeared in 24 different messages. Using the same logic of the Survey, evidence of the presence of a sub-construct is interpreted as evidence for the presence of the associated Wenger construct. Sub-construct codes are consolidated in Table 11 to provide a total count for the corresponding construct. Table 12 provides a qualitative summary of the same results organized by essential trait and listing the most frequently detected text-based manifestations of each sub-construct.

	CIVWAR	COBOL	CPLUS	CRYPT	FINPLAN	MEDTRAN	PHYSRES	TAXES	UKAGRI	VISOBJ	X
Number of messages in thread sample	129	133	91	346	93	106	107	117	119	119	
Learning or identity acquisition	**4**	**0**	**1**	**2**	**0**	**1**	**7**	**4**	**2**	**9**	
Acquiring new knowledge	4	0	1	2	0	1	7	4	2	9	
Acquiring new skills	0	0	0	0	0	0	0	0	0	0	
Acquiring and enacting a professional identity	0	0	0	0	0	0	0	0	0	0	
Shared repertoire	**162**	**211**	**274**	**444**	**101**	**109**	**142**	**321**	**132**	**182**	
Shared criteria	0	29	38	1	7	5	0	77	28	8	
Shared practices	39	45	22	118	5	21	12	22	29	58	

Shared artefacts										
Usenet artefacts	9	2	91	8	0	0	2	117	0	0
Symbolic language	0	2	24	15	1	0	23	0	1	15
Specialised tools	11	40	18	33	6	56	9	25	19	34
Cites	29	7	2	3	3	0	2	10	1	5
Jargon	74	86	79	266	79	27	94	70	54	62
Mutual engagement in practice	**216**	**174**	**101**	**399**	**160**	**63**	**171**	**198**	**101**	**205**
Collective problem-solving	0	0	11	272	29	3	32	89	26	50
Debating issues	129	133	45	44	65	24	75	22	45	57
Sharing information	29	5	7	14	6	3	16	20	8	6
Sharing knowledge	56	16	31	65	46	5	47	51	16	58
Sharing personal experience	2	20	7	4	14	28	1	16	6	34
Community	**3**	**0**	**1**	**4**	**0**	**6**	**1**	**2**	**15**	**0**
Members' knowledge of each other	1	0	0	4	0	5	1	2	14	0
Shared sense of community	2	0	1	0	0	1	0	0	1	0
Joint enterprise	**2**	**1**	**5**	**6**	**2**	**0**	**5**	**3**	**0**	**0**
Caring for a domain of knowledge	2	1	5	6	2	0	5	3	0	0
Auxiliary codes										
Asking a question	0	1	7	7	1	8	2	8	4	2
Off-topic digression	0	2	0	35	0	0	0	0	2	0
Friendly comment	0	3	5	13	4	27	2	9	49	16
Unfriendly comment	7	33	0	98	1	0	0	0	9	0

Table 11: Constructs and sub-constructs detected in each news group by the content analysis

Sub-construcs	Text-based Manifestations
learning / identity Acquisition	
Acquiring new knowledge	Thanking another poster(s) for learning something new Making an explicit mention of new understanding Self-questioning caused by reading the news group
Acquiring new skills	Not detected
Acquiring/enacting a professional identity	Not detected
Shared repertoire	
Shared criteria	Standards of professional or ethical conduct Official standard of a computer language Tax laws and other regulations, court decisions Commonly-known quality standards
Shared practices	IT-procedures, such as maintaining code Mathematical procedures, such as Gaussian elimination Accounting procedures, such as depreciating an asset

	Agricultural procedures, such as spraying
Shared artefacts	
Usenet artefacts	Fixed messages providing directions to the institutional documents
Symbolic language	Computer code Mathematical equations
Specialized tools	Trade magazines or books Specialized software or hardware tools
Cites	Literal quotations from accepted references
Jargon	Domain-specific technical language
Mutual engagement in practice	
Collective problem-solving	Critiquing or revising computer code Building a solution with mathematical equations Interpreting the meaning of specific provisions of tax law Discussing how to build/repair a physical tool
Debating issues	Debates were characterized by a set of messages, with an initial domain-related position and a number of follow-ups stating a contrarian position. Though intelligent arguments were the norm, rarely did either party change his/her original position.
Sharing information	Providing a relevant bibliographic reference Providing upon request a specific piece of information Providing a relevant piece of news about the profession
Sharing knowledge	Providing useful advice beyond a specific piece of information Providing an example (or counter-example) that throws light on the issue under discussion Drawing implications, either from previous posts or from new information provided in the same post Correcting a factually incorrect message
Sharing personal experience	A poster telling an anecdote from his/her experience (or from another person's experience) that throws light on the issue under discussion A request from one poster to another to share his/her experiences
Community	
Members' knowledge of each other	Explicit mention of another poster's expertise, opinions, health, etc. Posting a message addressed by name to another poster Agreeing to meet someplace
shared sense of community	Explicit mentions of 'our' news group or community Explicit mention of belonging to a community
joint enterprise	
Caring for a domain of knowledge	Proposing ways for novices to learn the domain Responding to criticism of the domain or its practices Commending a message that makes a contribution to the domain
Auxiliary Codes	
Asking a question	Requests for a specific piece of advice, information or additional data about a problem

Off-topic digression	A message that clearly veers away from the current discussion topic and/or the topic of the news group
Friendly comment	Pleasantries, humour, wit, greetings, introductions, praise, well-wishing, apologies
Unfriendly comment	Personal criticism, sarcasm, aggression, rebukes, accusations, insults, flames

Table 12: Most common text-based manifestations of the sub-constructs

The results of Table 11 show all sub-constructs originally hypothesized from Wengers constructs were found in the thread sample, with the exception of *Acquiring new skills* and *Acquiring and enacting a professional identity*. In addition, two new sub-constructs were detected and designated *Sharing knowledge* and *Sharing personal experience*. Both are distinct manifestations of mutual engagement, discovered during the first round of coding.

The overall results of Table 11 reveal a pervasive presence of mutual engagement and shared repertoire, which were detected through several different indicators in all news groups. There is also a smaller but unequivocal presence of the constructs of learning, community and joint enterprise. As in the survey, the presence of the essential traits is uneven across the eleven communities. Six of them display the complete set, others display as few as three. Thus, despite working with a relatively small textual sample from each news group, the content analysis has succeeded in detecting substantial text-based manifestations of the essential traits across all participating news groups. Although having their own internal validity and consistency, content analysis results must be combined with survey results as specified by the research design. This is addressed in the next section.

Triangulating survey and content analysis results

At this point, the *funnel strategy* can be brought to a close by combining the independently derived results from the survey and the content analysis into a single composite assessment concerning the presence of the essential traits in participating news groups. This is displayed in Table 13. Four news groups were found to display the full set of Wenger constructs. Two of them address computer topics (CPLUS and XTRPRG), while the other two (PHYSRES and TAXES) focus on non-computer topics. These four groups were found in Stage One to display all the exemplary traits of the virtual community of practice model, which determined their inclusion in the study. Now, at the end of Stage Two, they have been found to display every constitutive dimension defined by Wenger ([1998](#)) for co-located communities of practice. The presence of each essential trait has been independently confirmed by the survey and the content analysis. Therefore, these four online collectives can be classified as exemplary Usenet-based communities of practice.

	CPLUS	TAXES	PHYSRES	XTRPRG	MEDTRAN	UKAGRI	VISOBJ	CIVWAR	CRYPT	COE
Learning or identity acquisition										
Acquiring new knowledge	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	s
Improving professional skill	sv	sv			sv		sv			
Identifying with profession	sv	sv	sv		sv		sv		sv	s
Shared repertoire										
Shared artefacts										
Usenet artefacts	ca	ca	ca	ca				ca	ca	c
Symbolic language	ca		ca	ca		ca	ca		ca	c
Specialised tools	ca	ca	ca	ca	ca	ca	ca	ca	ca	c
Cites	ca	ca	ca	ca		ca	ca	ca	ca	c
Jargon	ca	ca	ca	ca	ca	ca	ca	ca	ca	c
Shared criteria	sv + ca	sv + ca		ca	ca	ca	ca		ca	c
Shared practices	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	ca	sv + ca	ca	ca	c
Mutual engagement in practice										
Collective problem-solving	sv + ca	sv + ca	ca		sv + ca	sv + ca	sv + ca		ca	

Debating domain-related issues	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	sv + ca	ca	ca	sv +
Sharing information	ca	ca	ca	ca	ca	ca	ca	ca	ca	c
Sharing knowledge	ca	ca	ca	ca	ca	ca	ca	ca	ca	c
Sharing personal experience	ca	ca	ca	ca	ca	ca	ca	ca	ca	c
Community										
Members' knowledge of each other	oq	oq + ca	oq + ca	oq + ca	sv + oq + ca	sv + oq + ca	oq	ca		
Shared sense of professional community	sv + ca	sv + oq	sv	ca	sv + ca	sv + ca	sv	ca	sv	s
Joint enterprise										
Caring for a domain of knowledge	sv + oq + ca	sv + oq + ca	sv + oq + ca	sv + oq + ca			sv + oq	sv + oq + ca	ca	c

Table Key: **sv** = survey scales; **oq** = survey open question; **ca** = content analysis
Shaded cells indicate concurring results

Table 13: Triangulation of survey and content analysis results for each sub-construct

The survey and the content analysis also found much evidence of the Wenger constructs in six other news groups. The fact that each sub-construct was detected in several diverse communities suggests both research instruments are robust and yet sufficiently nuanced to capture behaviours and artefacts indicative of a community of practice. Using both of them to make the assessment provides greater assurance of validity than either could afford on its own.

An additional news group, MEDTRAN, can be considered a borderline case for a Usenet community of practice, hence a natural target for further research. Neither the survey nor the content analysis found evidence for joint enterprise, even though the news group is focused on the distinctive profession of medical transcriber. One explanation could be that the real joint enterprise of members of this community has less to do with advancing the practice of medical transcription, as with reducing boredom and feelings of isolation by seeking the conversation and support of other online transcribers. This is consistent with the many off-topic messages posted by core-members and the relative lack of focus on medical transcription *per se*. It is also congruent with the joint enterprise Wenger detected in the claims processors' community of practice: because their profession did not carry with it a high status, they maintained a certain detachment from it; being *too* interested in the profession was not well regarded in their community (Wenger 1998).

It should be noted that the assessment of exemplary Usenet-based community of practice does not necessarily extend to the entire news group, but only to the stable virtual community located in the vicinity of the core. It is this dense communications cluster that was originally hypothesized and targeted by the virtual community of practice model in Stage One. Moreover, both the survey and the content analysis samples privileged participants with high coreness scores. Having said this, it is difficult to establish a clear boundary for the virtual community of practice, or indeed for its core. It may well be larger than the cores used for the content analysis sample, yet if direct mutual engagement is the key membership criterion (Wenger 1998), then it is certainly smaller than the survey sample, which ranged in size from 98 for TAXES to 211 for CPLUS. A new survey could probably establish a list of widely regarded members of each community of practice, but that is a topic for future research.

Discussion

The detection and theory-grounded assessment of four Usenet-based communities of practice and one borderline case, provides solid confirmation of the working hypothesis that launched this research and was outlined through the virtual community of practice model. Although the number of detected Usenet communities of practice is modest, this is an expected consequence of the triangulation rule and the high 'quality' standards set by the exemplary traits of the model. These high standards probably caused some valid Usenet-based communities of practice to be discarded along the way; hence the virtual community of practice model cannot be considered a general model for virtual communities of practice. Still, it was undoubtedly the exemplary traits that caused good candidates for a community of practice to be included in the study: of eleven participating news groups, seven displayed three or more Wenger constructs, even with the demanding triangulation rule (See Table 13). The one disappointment was news group FINPLAN, where no essential traits were detected, possibly because the news group was near the lower threshold of interaction activity (see Table 2).

The study thus achieves its intended aim: Wenger's (1998) theory of communities of practice does extend to the social areas of the Internet, because a systematic search of Usenet found operational news groups lacking none of the constitutive dimensions of co-located communities of practice.

The study makes two specific contributions to the community of practice literature. First, it confirms the existence of extra-organizational Internet-based communities of practice. Second, it applies an unabridged version of Wenger's framework. Specifically, the Wenger constructs are used to build the theoretical model, guide the Usenet search and rigorously assess detected virtual communities of practice. In the process, the study develops an approach that aims to operationalize the identification of the Wenger constructs within discussion forums. A practical output, the validated survey instrument, is offered as a potential tool for future studies. Item wording betrays the instrument's original use in news groups, but it can be easily adapted for other Internet forums.

The study also had weak aspects, where results did not match expectations. First, the content analysis found scant evidence for the sub-construct of shared sense of community and no evidence at all for Acquiring new skills and Acquiring/enacting a professional identity. The most likely explanation is the small textual sample analyzed in each news group. Second, in three of the detected Usenet-based communities of practice (TAXES, PHYSRES and XTRPRG), evidence from the open community question was evaluated as sufficient to satisfy the triangulation rule. Yet this evidence is statistically weaker than the evidence provided by the validated scales. Some subsidiary evidence for the sub-construct of Members' knowledge of each other is provided by the results of the core-periphery analysis. A cohesive core was one of the virtual community of practice model's selection criteria. Hence, core members of selected news groups are known to exchange a high volume of messages among them over the one-year period of observation. These intensive online interactions would gradually build familiarity and mutual knowledge, at least for the core subset.

Implications

Implications for theory

The finding that extra-organizational communities of practice spontaneously emerge in the social areas of the Internet constitutes new support for Wenger's (1998) position that communities of practice are naturally occurring social structures. In addition, it provides some confirmation, but also some contrast, to Brown and Duguid's (2000, 2001) theory of networks of practice and Wasko and Teigland's (2004) model of electronic networks of practice. Specifically, the findings of this study support Brown and Duguid's (2001) suggestion that communities of practice are high-density areas of larger networks of practice, because all detected virtual communities of practice operated at or near the relatively dense cores of news groups which were overall networks of practice by virtue of their shared practice. On the other hand, the findings do not support Brown and Duguid's (2000) and Wasko and Teigland's (2004) position that communities of practice are always co-located structures and only networks of practice can be Internet-based, because detected Usenet communities of practice lacked none of the constitutive elements defined by Wenger (1998). However, the finding that communities of practice can be Internet-based does not weaken network of practice theory *per se*, because placing a co-location restriction on communities of practice is not really necessary to its arguments, or to its usefulness in explaining knowledge leakiness and stickiness.

On a deeper conceptual level, the results of this study highlight a tension between Brown and Duguid's (2001) theory of networks of practice and Wasko and Teigland's (2004) model of electronic networks of practice. The former define a network of practice not in terms of interaction, like a community of practice, but only in terms of a shared practice and the inherent *potential* to share knowledge. Indeed, Duguid (2005: 113) recently characterized a network of practice as "the collective of all practitioners of a particular practice". On the other hand, Wasko and Teigland (2004: 27) define an electronic network of practice as "a self-organizing, open activity system focused on a shared practice that exists through computer-mediated communication," and they qualify further: "Knowledge exchange occurs through the mutual engagement revolving around a shared practice, creating an activity system in which individuals help each other solve problems by interacting with one another" (2004: 28). Thus their model of network of practice is conceptually richer than Brown and Duguid's, because it includes the activity of mutual engagement, which according to Wenger (1998) is the defining dimension of a community of practice. On a theoretical level, confirmed also by the findings of this study, this suggests that sustained mutual engagement has the potential to make an electronic network of practice evolve into an electronic community of practice, because members will gradually become acquainted with each other (i.e., will develop dyadic relationships), causing a community to emerge and will gradually develop a shared repertoire to make their engagement more effective. Core members of the network of practice are particularly susceptible to this evolution because by definition they are more active and in closer contact with each other. Thus, the more energetic an electronic network of practice is and the more it adopts a core-periphery structure, the greater the likelihood that it will evolve into a full-fledged virtual community of practice, a possibility Wasko and Teigland (2004) point to as well and which fits with the logic of the exemplary traits.

Among the reasons for targeting the Usenet discussion network in this study was the idea of exploring whether low media-richness would pose an obstacle to mutual engagement. The discovery of energetic Usenet-based communities of practice, some with fairly complex mutual engagement, supports Wenger *et al's* (2002) argument that it is the shared practice and the sustained engagement of members

that makes a virtual community of practice viable, rather than the richness of the medium. Furthermore, because news groups are just one of several Web technologies that support threaded discussions, it is reasonable to expect online communities of practice to exist in other social areas of the Internet, such as listservs, private discussion groups, or the newer blog and wiki-based forums.

At first sight, virtual communities of practice might seem an imperfect substitute for co-located communities. After all, people will, most likely, prefer to engage in person rather than over a computer, particularly when working on complex problems (Robertson *et al.* 2001). Hence, with respect to interaction richness, face-to-face communities of practice are superior. However, when interaction *convenience* is considered, virtual communities of practice frequently have the advantage, because they can be accessed from any place and they are always in session. Thus they are a permanently available source of help for members. Considering the fact that increasing numbers of employees are highly mobile (Hindle 2006; Kluth 2008), this availability is a huge advantage. In addition, virtual communities of practice potentially have the advantage of reaching the kind of world-class talent that few co-located peer groups can match (for instance, the membership of the CPLUS community includes well-known figures in the C++ Standard Committee). Of course, virtuality *per se* cannot guarantee the participation of world-class talent, but co-location certainly imposes an iron restriction.

Therefore it is likely that for individuals, it will *not* be virtuality or co-location that matters most, but the fact that for different problems, different communities of practice are better resources, because of their area of expertise or because of the people that participate. Hence, people will likely seek membership in both co-located and virtual communities of practice and adjust their participation to fully exploit learning and identity-acquiring possibilities.

Implications for practice

For individual practitioners Internet-based communities of practice can be a convenient and valuable resource for learning, enhancing personal practice and developing professional identity in a wide variety of fields. In this era of fast-paced change, regular mutual engagement with a network of knowledgeable peers is a good way of preventing one's competence from becoming stale. In addition, virtual communities of practice can provide a safe glimpse into a new practice and a new identity for people undergoing a career change (Ibarra 2003). They can also be particularly valuable to people who, through geographic or organizational isolation, lack a local peer group (Thomsen 1996; Wasko and Teigland 2002; Hara and Hew 2007). For instance, academics who do not find in their local departments a sufficient critical mass of colleagues working on their particular research topics (Pickering and King 1995) can try to locate, or even launch, an Internet community of practice focused on them. If they succeed, it may well become the equivalent of a permanently running conference and encourage the development of more personal publication-oriented networks (Lowrie and McKnight 2004).

The existence of extra-organizational Internet-based communities of practice holds important lessons for organizations as well. The fundamental premise for managers is that nowadays most business organizations operate immersed in large, densely connected knowledge ecologies, which provide both opportunities for knowledge acquisition and risks of knowledge loss (Brown and Duguid 1998). Achieving the former and preventing the latter should be part of management's agenda and at a minimum, this requires awareness of the existence and pervasiveness of these ecologies, which through the Internet can extend around the world. Moreover, managers should keep in mind that access to these knowledge ecologies is provided by mutual engagement in extra-organizational communities of practice, real or virtual, by the organization's employees. Therein lies the importance of securing the goodwill and loyalty of knowledge workers through well-designed human resource management policies (Newell *et al.* 2002). Handy (1994) makes the point that professionals today are more loyal to their profession (hence their communities of practice) than to the organization where they currently practice. The existence of world-class virtual communities of practice provides talented employees with a convenient benchmark for comparing the projects and teams they are currently working on with those of their peers at other companies. For employing organizations, this translates into constant competition for the hearts and minds of talented people (Bartlett and Ghoshal 2002).

Directions for further research

Theoretically grounded research about Internet-based communities of practice is still in its infancy. This section suggests directions for further research, in Usenet and other Internet areas and points to several recent studies that are breaking new ground.

Further research within the Usenet network

The virtual community of practice model provides a useful baseline for further exploration of Usenet. This study defined its intended target narrowly in order to make the discovery task easier, but by selective relaxation of the assumptions of the virtual community of practice model, particularly in the exemplary trait set, a broader view of virtual communities of practice can inform future research. Specific directions include searching Usenet with less restrictive quantitative filters and examining domains other than strictly defined professions, in order to expand the scope of feasible Usenet-based practices.

More broadly, there is a need for ethnographic studies of Usenet communities of practice that are based on Wenger's theoretical framework. Such studies could unobtrusively examine archived news group discussions without inconveniencing participants and would greatly improve our understanding of the day-to-day mutual engagement of community members.

Quantitative studies can also provide deeper insight into members' interactions. For instance, Fisher, Smith and Welser (2006) recently used egocentric social networks to identify the different roles participants can play within specific news groups.

Research in other Internet platforms

Among traditional Internet technologies, listservs or mailing lists constitute a practical platform for groups of professionals wishing to launch and operate a virtual community of practice. In a noteworthy article, Hara and Hew (2007) use content analysis of messages and 27 member interviews to build an in-depth case study of an online community of advanced practice professional nurses. In their depiction of the group as an online community of practice the authors apply Wenger's (1998) theory, but take as the defining dimensions practice, community, meaning and identity. However, these are the elements of Wenger's social theory of learning, in which communities of practice constitute a single element (Wenger 1998: 5). Notwithstanding this difference of interpretation, reported evidence of the essential traits is sufficient to support the authors' characterization of the community as a successful listserv-based community of practice.

Another traditional technology is e-mail. Similar to news group and listserv messages, e-mails have headers that identify the sender and the receiver of the message. This information can be examined through social network analysis to detect non-random communication patterns. In an exciting development, Tyler *et al.* (2005) have designed an algorithm that efficiently explores mail server log data, using just the 'To:' and 'From:' fields. Based on a *betweenness* centrality social network measure, the algorithm can identify normally invisible organizational communities of practice and even point out the members who play leadership roles within them. Moreover, the procedure can be applied to other types of communication networks, such as telephony, instant messaging and mobile devices.

With respect to newer technologies, Web 2.0 platforms have experienced explosive growth in the past few years (O'Reilly 2005; Dearstyne 2007). Blogs, wikis and social networking sites constitute potential platforms where distributed participants can sustain mutual engagement and eventually cohere into a community of practice.

Blogs are frequently updated, personal Web pages that display entries in reverse chronological sequence. They can be quickly launched by any individual and they provide a much richer medium than text-based news groups or listservs, allowing embedded images, audio and video. In a useful article, Herring *et al* (2005) built a systematic empirical profile of 203 randomly selected blogs, which rectifies some of the popular accounts carried by the contemporary press.

Studies aiming to detect blog-based communities rely on social network analysis of the links bloggers make to entries in other related blogs. Kumar *et al* (2003) have developed a procedure for mapping blog communities, which they define as sets of blogs that link back and forth to each other's postings while discussing common topics. Chin and Chignell (2007) initially detect the social network of the blog community and then complement this measure with a quantitative survey of community members to test for the construct of 'sense of community'.

A noteworthy qualitative study of a blog-based community is that of Kaiser and his colleagues (2007) with its depiction of the discursive and interactive practices in Microsoft Longhorn Blogosphere, a community of expert developers engaged in lively discussion of an upcoming version of Windows. The authors suggest the community of practice concept applies to this community, but make no attempt to use Wenger's (1998) framework. Nevertheless, their rich description strongly suggests that the archived discussions of the Longhorn Blogosphere are an excellent target for future research on blog-based communities of practice.

A second recent technology is wikis, which are Web pages that are easily editable using a Web-browser (Konieczny 2007). Wikis are designed to support collaborative projects; they are ideally suited for creating and editing online knowledge repositories. They also offer separate discussion pages, where the rationale for changes to the knowledge base can be argued (Konieczny 2007). These technical features support both mutual engagement and shared repertoire, thus affording an excellent platform for launching online communities of practice.

The most popular application of wiki technology is Wikipedia, the online encyclopedia. Bryant *et al.* (2005) provide a case study of participation in Wikipedia as an induction into an online community of practice, *becoming Wikipedian*, as it were. They apply Lave and Wenger's (1991) concept of Legitimate Peripheral Participation to describe the induction of novices into the Wikipedia community. Furthermore, they report the presence of Wenger's (1998) traits of mutual engagement, shared repertoire and joint enterprise. Although the question remains of whether this is truly a single community or rather a constellation (Wenger 1998), the study makes a strong case for a wiki-based community of practice.

A third technology offering new possibilities for virtual communities of practice is social networking sites. Boyd and Ellison ([2007](#): 211) define social networking sites as *"Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection and (3) view and traverse their list of connections and those made by others within the system."* Facebook and MySpace are the best-known sites. Boyd ([2006](#)) and Thelwall ([2008](#)) have published useful empirical profiles of MySpace members, which contrast somewhat with current media depictions.

To date there are few studies of virtual communities based within social networking sites. Ellison *et al.* ([2007](#)) have found a positive relationship between online social capital and Facebook usage, but they emphasise most members use the site to maintain or intensify offline relationships. Hence, the technology's appropriateness for supporting online communities of practice remains to be seen.

This necessarily brief overview of current research about virtual communities of practice gives grounds for cautious optimism. It is still the case that comparatively few studies engage with Wenger's theoretical framework or propose a developed alternative. Still, research about Internet-based communities of practice is growing rapidly and is now expanding into new technological directions. This will lead, we hope, to a greater prevalence of theoretically grounded studies.

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Appendix 1 - Validated survey instrument

The validated instrument is provided as a potential tool for future study of Internet-based communities of practice. It is organized into the original four thematic blocks and omits items discarded by EFA, hence its reduced size. Items are numbered according to their (randomized) position within each block, yet they are grouped under the validated scale they belong to. Sub-construct names appear on the right, although they should not normally be displayed in the survey itself.

Dear (Participant's name),

This survey addresses knowledge sharing in news groups whose discussion is focused on a professional discipline (e.g., computer programming, financial planning, history, law, etc.). The survey is organized into four major topics containing 8-12 questions each, plus one open question and a few socio-demographic questions at the end. As you answer, please keep in mind the following conventions:

"The profession" refers to the profession or discipline the news group is focused on.
"Members of the news group" are people who post regularly to this news group.

In addition, the following response codes are used throughout:

SD = Strongly disagree
D = Disagree
N = Neutral
A = Agree
SA = Strongly agree

learning THROUGH PARTICIPATION IN THE news group (12 items)	
1.11 Participation in this news group has increased my ability to quickly analyse a case or problem 1.7 Participation in this news group has improved my problem-solving skills 1.9 Participation in this news group has helped me to develop my own professional style 1.10 Participation in this news group has helped me to improve my skills 1.5 Participation in this news group has raised the level of professionalism I hold myself to	**Improving professional skill**
1.3 Participation in this news group has led me to acquire new knowledge	

1.4 Participation in this news group has led me to develop new understanding 1.6 Participation in this news group has led me to acquire new insights	**Acquiring new knowledge**
1.12 On a professional level, I strongly identify with members of this news group 1.8 Part of my professional identity is continuing membership in this news group 1.1 Participation in this news group has expanded my stock of professional knowledge 1.2 Participation in this news group has helped me to develop my own professional viewpoint	**Identifying with the profession**
MEMBER INTERACTION IN THE news group (8 items)	
2.1 Members of this news group collaborate online to build solutions for real world problems or cases 2.4 Members of this news group are adept at combining individual contributions to build a solution for a problem or case 2.3 Messages posting difficult problems or cases will usually produce a collaborative effort from members of the news group to build a solution 2.6 Developing solutions to difficult problems or cases will usually involve the combined contributions of several members of the news group 2.8 The experience of this news group illustrates how collaborative online discussion can be an effective way of tackling difficult problems or cases	**Collective problem-solving**
2.5 I enjoy following the debates of issues that relate to the profession in the news group 2.2 I have learned a lot about the profession by watching members debate the issues 2.7 Debating issues with other members of the news group has helped me to build solid arguments	**Debating domain-related issues**
news group-SPECIFIC TOOLS AND STANDARDS (9 items)	
3.8 Members of this news group largely agree on criteria for evaluating quality in the profession 3.5 Members of this news group mostly follow the same professional standards 3.9 Members of this news group largely agree on what constitutes good and bad practice 3.3 Members of this news group largely agree on criteria for evaluating performance in the profession 3.1 Members of this news group largely agree on criteria for evaluating ethical conduct in the profession	**shared criteria**
3.6 This news group has best practices members often refer to 3.7 This news group has developed some new practices through discussion 3.2 Many members joined this news group mainly to learn how other practitioners do things 3.4 Members of the news group use technical language when discussing problems or cases	**shared practices**
COMMUNITY traitS IN THE news group (11 items)	
4.4 Members of this news group see each other as trusted colleagues 4.3 Members of this news group share a mutual commitment to the aims of the news group 4.2 Members of this news group are comfortable asking each other for help 4.8 Members of this news group are highly committed to the profession 4.5 Members of this news group think of it as a stable community 4.1 Members of this news group have had online interaction with each other for years	**shared sense of professional community**
4.10 I know the other members of the news group very well 4.11 The other members of the news group know me very well 4.6 I have built strong ties with some members that I have never met in person 4.9 When I need specialized help or advice, I know which members of the news group I should ask 4.7 In my experience, you can get to know a person very well just from reading her/his messages often enough	**Members' knowledge of each other**

41. Open Question: Do you consider this news group a community and why?

SOCIODEMOGRAPHIC QUESTIONS

42. Please state your age
43. Please state your gender
44. Please state your profession
45. How long have you been a member of this news group (in months)?
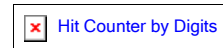46. How would you rate your expertise in the topic of this news group?

Appendix 2 - Coded and commented fragment from thread TAXES1

The following table displays a coded fragment of the discussion thread TAXES1 (all names are disguised). The first column displays the original Usenet text grouped into Nudist text-units. The second column displays the Nudist codes assigned to the text and the third column provides a rationale for this assignment.

Nudist text-units	Nudist codes	Comments
From: Steve	core member	Steve's coreness score is 0.12
Someone pointed this out to me today. From Pub 17, Your Federal Income Tax (EMPHASIS added)	sharing information specialized tools	A specific and relevant piece of information discovered in a profe tax publication.
[BEGIN QUOTE] Business Use or Rental of Home Depreciation for business use after May 6, 1997. If you were entitled to take depreciation deductions because you used your home for business purposes or as rental property, you cannot exclude the part of your gain equal to any depreciation allowed or allowable as a deduction for periods after May 6, 1997. IF YOU CAN SHOW BY ADEQUATE RECORDS OR OTHER EVIDENCE THAT THE DEPRECIATION DEDUCTION ALLOWED WAS LESS THAN THE AMOUNT ALLOWABLE, THE AMOUNT YOU CANNOT EXCLUDE IS THE SMALLER FIGURE. [END QUOTE]	sharing information cites	The literal citation from the publication is identified as such, quot precisely and the interesting bit highlighted.
The same passage appears in IRS Publication 523, Selling Your Home and IRS Publication 587, Business Use of Your Home (Including Use by Day-Care Providers). Clearly, the IRS is saying in its publications that if the taxpayer can show that no depreciation was taken, then no recapture of depreciation is required. This "exception" does not seem to prevent reduction in basis required for allowable depreciation. Thus, the gain is larger, even if depreciation is not taken, but no taxable gain is created if the depreciation is not taken. Gain would be taxable only if the total excluded the exclusion amount available from Section 121. Does anyone have any comment on this? In particular, I'd like a specific citation that confirms or refutes what the IRS put in three publications. Regards, Steve	sharing information specialized tools sharing knowledge shared practices, jargon shared criteria collective problem-solving	Identifies repeats of the relevant passage in other IRS publicatio Analyzes the regulation and proposes his interpretation of the IR position. 'Recapture of depreciation' and 'reduction in basis' are shared accounting practices and they are referred to with technical langu A Section of the Internal Revenue Code (IRC) is an accepted crit Explicit request for alternative interpretations and for cites (of law Tax Court decisions) that confirm or refute the problematic pass
<< the charter and the guidelines for posting to this news		Moderator-inserted message pointing novices and visitors to

group are at www.misc-taxes-moderated.com >>	Usenet artefact	institutional documents of TAXES.
From: Tom	core member	Tom's coreness score is 0.592
> Does anyone have any comment on this? In particular, I'd > like a specific citation that confirms or refutes what the > IRS put in three publications.	quote	Tom quotes the previous message to provide context for his repl
You have to follow the reference back to §1250(b)(3) that you'll find in §121(d)(6) for computing the amount subject to this special tax. §1250(b)(3)'s final sentence says:	sharing information shared criteria	Seeking out the applicable law (a shared criterion) which provide basis for this 'special tax'
"For purposes of the preceding sentence, if the taxpayer can establish by adequate records or other sufficient evidence that the amount allowed as a deduction for any period was less than the amount allowable, the amount taken into account for such period shall be the amount allowed."	cites	The passage identified and quoted literally to show it matches the passage quoted by Steve.
The above is essentially what the IRS has lifted, word for word, in the instructions. §121 refers specifically to this provision in §1250 (which deals generally with "excess" depreciation for real property recapture rules) rather than talking about depreciation in general. It does not refer to the general rule for basis adjustments under §1016(a)(2), which is where the "general" allowed or allowable rule comes into play. This creates some interesting problems <grin>. Remember, the IRS position appears to be that if a space was used as a home office for over three years of the five year period, then §121 does not apply to that space. So that office would be subject to the more general "allowed or allowable" rule--and gain would be recognized even though depreciation had not previously been claimed. However, if the space was "disqualified" for two years (note I said disqualified--not just no depreciation taken), then the ability to document that the "allowed" amount was less than the amount "allowable" would come into play. Where that could be a problem would be if an adviser, reading the above from the publications (and, to borrow from another thread, quick reference guides citing the same <grin>), counseled a client to go ahead and claim all other home office related expenses (utilities, insurance, etc.) but not claim the depreciation, with the theory that now the home was "safe" from being taxable in any amount on sale. By claiming those expenses, the taxpayer is taking the position the space *did* qualify for depreciation right up through the date of sale. In that case, §121(d)(6) would not apply (at least by the IRS's analysis) and the taxpayer would end up paying tax on a gain computed using the "allowable" depreciation amount. Ain't tax research fun...	sharing knowledge, shared criteria jargon sharing knowledge shared criteria jargon shared criteria specialized tools sharing knowledge collective problem-solving, caring for a domain of knowledge, friendly comment	Analysis performed, specifically interpreting the situations where regulation applies. Accounting language used. Drawing implications, specifically where this passage may be cau confusion. The position the IRS has maintained recently (very familiar to the professionals) becomes an accepted criterion Accounting language used. The position the IRS has maintained recently. The publications of the IRS are accepted professional references. Analysis performed: the taxpayer's position is open to challenge IRS Tom explicitly joined the problem-solving exercise convened by S Furthermore, he enjoyed it (thus showing his care for the domair makes a good-humoured comment to Steve.
<< the charter and the guidelines for posting to this news group are at www.misc-taxes-moderated.com >>	Usenet artefact	Moderator-inserted message pointing novices and visitors to institutional documents of TAXES.
From: Steve	core member	Steve's coreness score is 0.12

> Ain't tax research fun...	quote	Steve quotes the previous message to provide context for his rep
Actually, yes. Thanks for your comments. Regards, Steve	caring for a domain of knowledge, acquiring new knowledge, friendly comment	Steve also cares about taxation, has acquired the knowledge he from the exchange and appreciates Tom's response.
<< the charter and the guidelines for posting to this news group are at www.misc-taxes-moderated.com >>	Usenet artefact	Moderator-inserted message pointing novices and visitors to institutional documents of TAXES.

Contents | Author index | Subject index | Search | Home