

G. Riva, M.T. Anquera, B.K. Wiederhold and F. Mantovani (Eds.)
From Communication to Presence: Cognition, Emotions and Culture towards the Ultimate Communicative Experience. *Festschrift in honor of Luigi Anolli*
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4 Presence as a Dimension of Communication: Context of Use and the Person

John WATERWORTH, Eva L. WATERWORTH

Abstract. We claim that presence is elicited most strongly when information is presented as an inhabitable, external world. Technical developments that permit this, such as the creation of interactive, immersive virtual environments herald a profound change in how people relate to sources of information, and how they communicate. This change has psychological, social and cultural effects. It has been claimed that in many ways, our relationship to information becomes that of our ancestral, pre-literate relationship to the physical world. By this view, we are heading for a post-literate future of body-based communication. But this view is too simple, since information must serve a variety of purposes, and how much presence is desirable in a communicative situation depends on many factors, including the communication devices available, the intended use and the context of use. In addition, differences between individuals, such as personality, as well as physical and psychological state, will affect how readily presence is invoked and also its impact on the individual concerned. In this chapter, we expand on the general notion of presence as a dimension of communication, and how this perspective can inform an understanding of designed variations in presence as a function of use, context, and individual psychological factors.

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From Communication to Presence
Cognition, Emotions and Culture towards the Ultimate Communicative Experience
Festschrift in honor of Luigi Anolli
Volume 9 Emerging Communication: Studies on New Technologies and Practices in Communication
Edited by: G. Riva, M.T. Anguera, B.K. Wiederhold, F. Mantovani
September 2006, 323 pp., hardcover
ISBN: Pending **NEW**
Price: US\$134 / €107 / £72

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Price: US\$175 / €140 / £95

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Edited by: G. Riva and F. Davide
2001, 292 pp., hardcover
ISBN: 1-58603-162-7
Price: US\$116 / €105 / £74

IOS Press

<http://www.booksonline.iospress.nl>

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4.1 Introduction: Presence as Consciously Being in an External World

Our theoretical stance suggests that presence originated as the feeling of something happening to an organism from outside rather than from within (see also the chapter by Riva in this volume). In other words, it distinguishes self from other. In complex organisms such as humans, presence has evolved into the ability to distinguish external, perceived events from internal, imagined or otherwise internally-modeled events. This is still a vital distinction, because imagined events evoke the same emotional responses as external events; otherwise we would be unable to evaluate the desirability of planned actions and possible outcomes, or learn by contemplating past mistakes.

Unfortunately, terminological and other confusions about what comprises presence, and what does not, have impeded progress in the field. At the current time, no unifying theory of presence is possible, because the word “presence” is being used differently by different researchers. Perhaps we need different words for these different meanings, as Slater suggested [1].

As he suggests, what Slater means by presence could, perhaps more accurately, be labeled *pretence*. According to Webster's online dictionary, this means “An artful or simulated semblance”. This is consistent with his earlier [2] definition of presence as:

“the total response to being in a place, and to being in a place with other people. The ‘sense of being there’ is just one of many signs of presence - and to use it as a definition or a starting point is a category error: somewhat like defining humor in terms of a smile” (p. 7).

The problem with this is that it begs the questions: which place, and what response? If presence (in a virtual environment) is the total response to a simulation, as compared to the response to the physical environment being simulated, then what about fictional virtual environments? Can we not measure presence in them? And if no comparison with reality is involved, how can something as unspecific as “total response” be quantified? This view seems to boil down to the most common everyday meaning of presence, of being physically present somewhere. But in this case, one can be present while mentally elsewhere or nowhere - say, on the phone, solving a difficult cross-word puzzle, asleep, or even in a coma. This view seems to imply that presence is simple the degree of similarity with physical reality, not a thing that can be experienced in itself (*feeling* more or less present). In contrast, we view presence as a feeling.

Some researchers (e.g. [3, 4]) maintain that presence can be evoked equally well by imagining a world as by directly perceiving and acting in it (the “book problem”). But for us, presence is the feeling of “being there” in the present, the here and now of the physical or a virtual world. The feeling one gets from absorption in an internal world (a novel, a fantasy, or whatever) is quite different, which is why healthy people almost never confuse the two [5, 6]).

In an internal imagined world the person does not experience the same degree of emotion, for example reading a scary text does not usually evoke the same degree of fear as the situation would when acting in a physical or a virtual world. Imagined worlds are often not related to real time; a book can be put down, a line of thought can be suspended until later. When reading the text of a book, one can only directly

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perceive the abstract symbols of written language. To make sense of those symbols, the reader must construct what is represented in internal, mental space.

We suggest that *presence* must be tied to the *present*, the here and now, real time world – that is, the *perceived* world of the body and its surroundings (in which the perceiver is able to act). Its evolutionary purpose is to enable us to distinguish what is happening around us, now, from what we may create in our imagination - the external versus the internal. The extent to which a medium invoked presence therefore depends on the extent to which the information presented is presented as an external, perceivable world. We agree with Heeter [7] that “Presence occurs during periods of time when cognition (processes such as perception, attention, learning, thought and affect ...) is closely tied to current perceptual stimuli.”

Of course, any useful definition must exclude things, and a useful definition of presence must have implications for what is not presence [8]. This has been termed “*absence*”, a state of absorption in an internal world [9, 5] detached from the current perceptual flow. By introducing the concept of “absence”, presence can be distinguished from other concepts with which it is sometimes confused, including engagement, attention, or even consciousness itself.

A counter argument is sometimes made [4], that we experience high presence when dreaming, when we are not perceiving or acting in the external world (the “dream state problem”). We suggest that dreaming while asleep is a special case (“dream presence”), in that our motor systems are immobilized while we dream to prevent damage to ourselves and those around us. In the rare cases that this defense fails, the results are shocking: we may wake up in a state of paralysis (failure to turn the defense mechanism off), or we may act out deeds totally against our normal waking nature (failure to turn the defense mechanism on); see for example [10]. When dreaming we do - by definition - mistake the internal for the external because, we suggest, the presence mechanism is suspended when dreaming, along with motor responses.

Organisms must be attentive to relevant perceptions of the current external world in order to carry out successful actions in that world. Action in the world requires information that is not available from imagination. At the same time, communication seems to rely on a degree of abstraction from the world; of mental reflection in relation to possible or actual action. We cannot direct our attention fully to both action in the world and communication about that action or other possible actions, and communication itself can be seen as a form of action.

We can see several common psychological problems, for example PTSD, depression, phobia, panic attacks, as examples of a maladjustment of the normal presence mechanism, which may be set too high or too low for the needs of the individual concerned. The power of presence – as we define it – in psychotherapy stems from the ability to override and reset this faulty mechanism, either by adjusting it upwards or downwards. What is too much or too little presence also depends on the individual concerned and we discuss this aspect, especially, in subsection 4.5.2.

The power of presence is that it ensures that we orient ourselves to significant external events, and we describe in more detail in the next section how this relates to its evolutionary function. The danger is that presence evoked by communication forms, by orientating us towards synthesized external events, may distract us from significant real events in the physical world in which we are located. We discuss this point further in subsection 4.5.1, on the importance of communicative contexts.

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4.2 The Three Layers of Presence

Riva, Waterworth and Waterworth [6] present a model of presence as consisting of three potentially contributing layers: proto presence, core presence, and extended presence (see Figure 1), based on Damasio's neurological account of the evolution of the human psyche ([11, 12]).

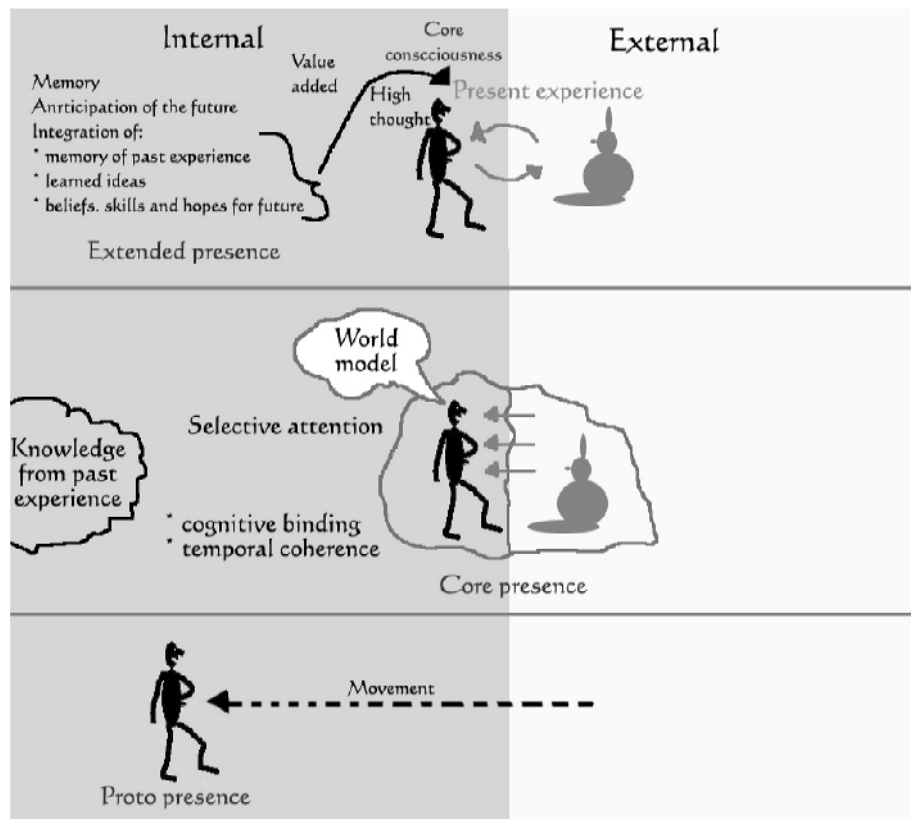


Figure 1. The three layers of presence (from [6], with permission)

Proto presence is based in embodiment, of what is the self versus what is not, and depends on the level of sensori-motor coupling. Core presence depends on the ongoing conscious perception of the current state of the world in which a person finds herself, of being in a perceived world. In contrast, extended presence depends on the cognition of relations between the current situation and past or imagined future situations, of the self in relation to what is happening in the world.

Unless core presence is invoked, the overall level of experienced presence will be relatively low. The other layers may reinforce core presence, or detract from it. Proto presence is determined only by form of information experienced, core presence by both form and content, and extended presence only by content.

It is not a simple matter to create the illusion of being in a computer-created reality, to be convincing at all three levels of the psyche. While significant progress

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has been made in recent years with specific kinds of virtual environment, current approaches are unlikely ever to generate a general solution to this problem.

Mimicking natural interactivity in an immersive environment involves rapid response times between a medium and its user, and often involves detailed inspectability of aspects of any displayed information. Proto presence has the most demanding technological requirements, and was the last of the three layers to be addressed through media. In a virtual world this is sometimes known as “spatial presence” and requires the tracking of body parts and appropriate updating of displays. Core presence is based largely on vividness of perceptible displays. This is equivalent to “sensory presence” (e.g., in non-immersive mediated environments) and requires good quality, preferably stereographic, graphics and other displays. The extent to which these two levels are integrated produces what is usually called degree of immersion. If proto presence is not invoked appropriately, for example with poor or slow coupling between body movements and display changes, it will detract from the overall sense of presence in a mediated experience.

Extended presence relies on working memory ([13, 14], see also [12]), which can be seen as the “active scratchpad” of mental [15]. It allows us to consider the significance and consequences of events. When this cognitive work is applied to the current external situation, presence will be reinforced; but when applied to other mental content, it will lower the overall sense of presence.

An additional factor that affects the level of presence experienced is the type and intensity of the emotions that are evoked. In tests conducted in a virtual environment called the Exploratorium [16] the results indicates that people felt much more present in the Inferno (a scary, hellish place) than in Paradiso (a relaxing heavenly place). The Exploratorium was developed as a so called mood device, and the aim is to induce different kinds of moods via technology. The intention of the Inferno is to elicit anxiety and in Paradiso the intention is to induce calm [17]. The intensity of an emotion is the level of activation or the level of arousal [18]. It seems that more intense negative emotions tend to elicit a higher degree of presence; most likely due to the instinct for self preservation. Emotions such as disgust, fear, and anger will tend to elicit a high degree of presence, whereas emotions such as tranquility, motherly feelings and grief elicit low level presence. In general, more intense positive emotions do not evoke higher levels of presence, whereas more intense negative emotions do.

According to our three-layer model, the overall presence level depends on how well integrated the cognitive system is to focus on the environment around the individual. Emotion can affect this in several different ways, for example, by creating an arousing effect that orientates the individual to attend to the environment (stimulating presence) from the bottom up. On the other hand, emotion induced at the extended layer of the psyche may increase attention to the environment or reduce it, depending on whether the content is associated with the current environment or opposed to it.

4.3 Presence and Time Perception

Variations in the ongoing experience of being-in-the-world can be seen as reflecting the changing ways in which we deal with information, from the physical world and through media. When vigilantly on the look out for the occurrence of a specific event

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- say the arrival of a loved one at a pre-arranged, public meeting place - one's experience of being in the world is quite different from when one is lying on a sun bed, daydreaming, or reading a newspaper. In the first case, a large part of attention is devoted to sampling what is currently happening in the physical world; in both the second and the third cases, we pay little attention to the physical world. These differences affect how much presence we feel, and they also affect our perception of time-in-passing.

Like our varying sense of presence, our experience of time-in-passing is also a reflection of features of the information with which we are dealing. The picture is complicated by the fact that duration estimates change as a function of the time elapsed from the end of the test interval to the time the estimates are taken. A familiar example is that a period that seems slow in passing may appear very short in retrospect (vacations are a notorious case of this). Time seems to pass relatively quickly for us when working memory is heavily loaded, so that attending to information that requires significant conceptual work will tend to result in shorter duration estimates than when the ongoing memory load is lighter, other things being equal, and if the estimates are taken during or immediately after the test interval ([19]; see also [20]).

The relation between presence and experienced duration is a contentious issue. Different researchers disagree on how presence affects the subjective experience of duration. Some researchers have suggested that if the degree of experienced presence of an interval were high, then the subjective duration would tend to be short (e.g. [21, 22]). In contrast, Waterworth and Waterworth [5] found evidence that when there is a correlation it is positive, with long duration estimates corresponding to high presence judgements.

Taken together, our sense of presence and our sense of time-in-passing constitute a way of characterizing our ongoing relationship with information. When we are predominantly attending to an external world, we will tend to feel relatively high presence; and when we are mostly attending to an internal world or worlds we will tend to experience relatively low presence. We can thus envisage four paradigm cases: high presence with low working memory load, low presence with low working memory load, high presence with high working memory load, and low presence with high working memory load (see Table 1):

Table 1. Being-in-the-world: presence and time perception

	External world focus	Internal world focus
Low working memory load	Watching the sun set (High presence/slow time)	Daydreaming (Low presence/slow time)
High working memory load	Climbing a difficult rock face (High presence/fast time)	Solving a logical puzzle (Low presence/fast time)

If time-in-passing depends on ongoing working memory load (also referred to as “conscious processing load” or CPL), whereas presence depends only on the internal/external focus of attention, we would expect no correlation between the two. In fact, there is some evidence that subjective presence ratings and estimates of elapsed duration are correlated, but not in a simple way.

Waterworth and Waterworth [5] found that different versions of a media production elicited different levels of presence, depending on the degree of

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abstraction of the information presentation (see Figure 2). All versions told the same story and were isomorphic in terms of events and timings. As indicated in the figure, four media streams were used:

- a real/concrete stream (filmed events with natural soundtrack - the *Camera* stream),
- a real/abstract stream (text, sketches and spoken words describing events - the *Words* stream),
- a virtual/concrete stream (a detailed animated 3D graphics version, with synthesised sound effects - the *3D* stream),
- and the virtual/abstract stream (a wireframe 3D with text labels and stylised synthetic sound effects - the *3D Wired* stream).

In this study, we found that when the abstraction level of an experience increased, the feeling of presence decreased, and vice versa, and that when the subjective experience of presence increased, experienced duration also increased, but only under certain circumstances. Figure 3 shows the relationship between presence ratings and duration estimates over four test durations (23, 50, 77 and 104s) for one of the media streams. The two sets of data were significantly (though modestly) correlated, but this was only true for one media stream, the *3D Wired* condition.

We suggest that our three-layer model of presence (described in Section 2) can help explain this kind of situation-specific correlation. As already mentioned, the model proposes three layers of the psyche that may contribute to our overall sense of presence in a situation, only one of which relies on working memory. Variations in the contribution of this layer (“extended presence”) will be correlated with changes in duration estimates, whereas variations in the contribution of other layers will not. This is indicated by the lack of variation in duration estimates across rows in Table 1, compared with the lack of variation in presence across columns.

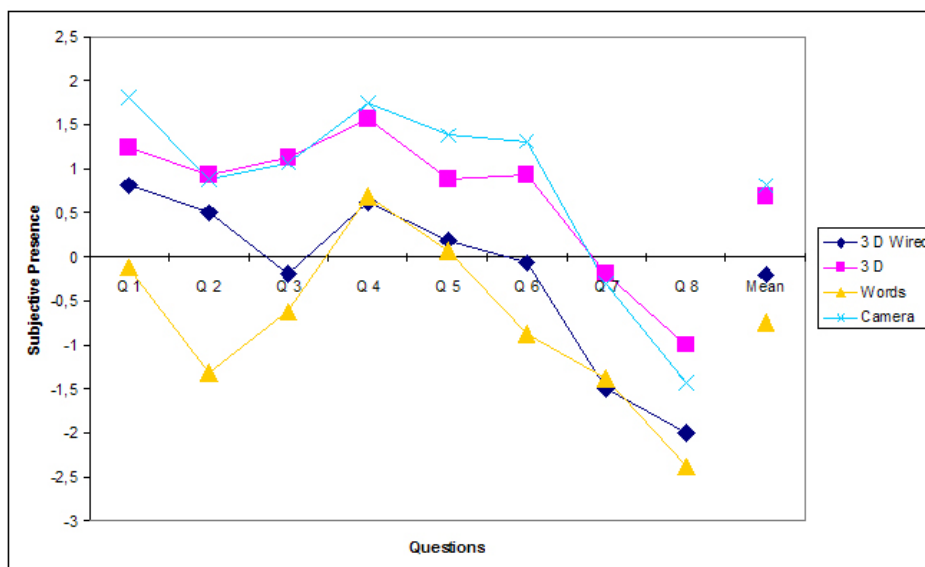


Figure 2. Subjective Presence for Different Media Forms
 (from Waterworth and Waterworth, 2003)

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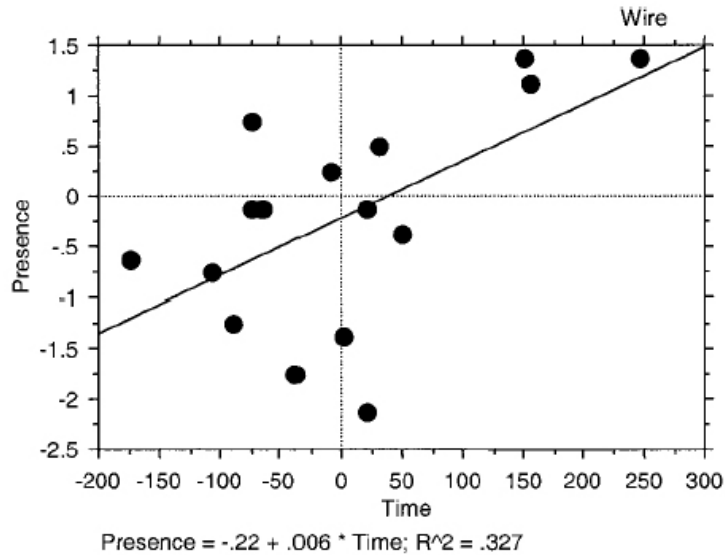


Figure 3. Scattergram, including regression (from [5], with permission)

Our interpretation of these results is that only in the *3D Wired* condition were both core and extended presence invoked. Hence, only in this condition were duration estimates and presence ratings found to be correlated.

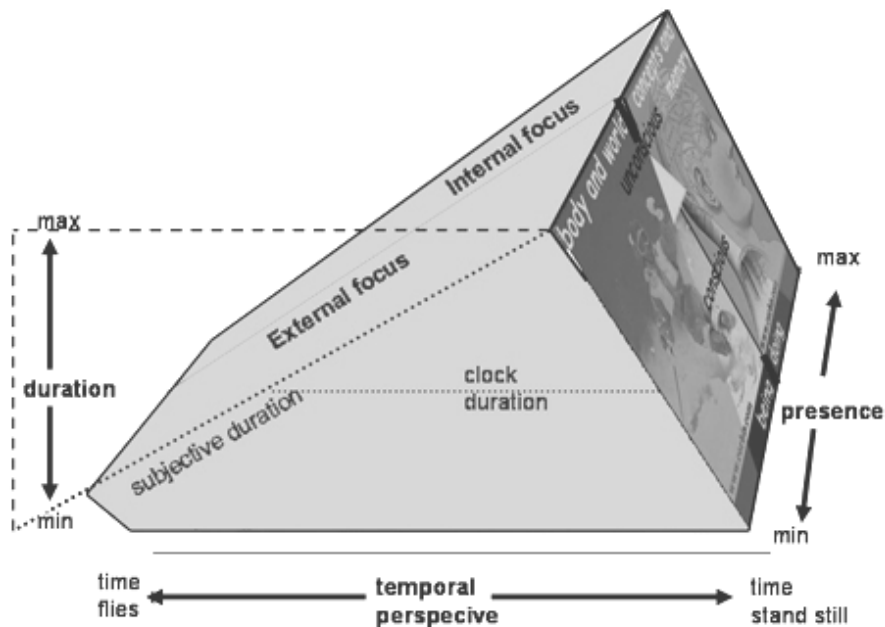


Figure 4. Presence level and temporal perspective

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Various extraordinary states of consciousness can be interpreted in terms of the combination of the two dimensions depicted in Table 1 and Figure 4: presence level and temporal perspective. When experienced presence is high, and working memory is heavily loaded (so that time seems to fly) this may correspond to what has been called “the flow experience” [23]. A literally ecstatic state (out from the internal, into the external), in contrast, may refer to a combination of external focus and low memory load, when presence is high and time seems to stand still. When low presence and high working memory load are combined, a state of absent-mindedness with automatized actions prevails; attention is directed almost exclusively to the internal and time passes quickly. And when low presence is combined with low working memory load, the individual may be experiencing a trance-like state, with an internal focus, but processing only the simplest of conceptions perhaps, for example, mentally repeating a simple mantra.

4.4 Dimensions of Communication

We have suggested elsewhere, and most researchers would surely agree, that the form in which information is presented will have an effect on the level of presence experienced, with more abstract forms tending to elicit lower levels of presence. It is also generally accepted that the content of information will affect the level of experienced presence. (The usual, though not universal, view is that we will feel more presence with engaging information than with boring information, while our own position is that content that stimulates more interest in the currently-present environment will raise the level of experienced presence). Here, we suggest that the level of presence elicited by the presentation of information in a particular medium comprises a necessary dimension for understanding the cognitive effect of messages conveyed through a given medium (see also the chapters by Mantovani and Riva in this volume).

Table 2 presents a rough first attempt at tabularizing the different dimensions that might comprise an adequate characterization of a particular communication form. The first dimension is the classic Shannon and Weaver [24] formulation where information carried by a communication channel is measured in terms of the reduction of uncertainty, which is inversely related to redundancy.

The second, storytelling, refers to the fact that any communication channel can be used to convey different kinds of story, where a narrative can be specified in terms of the structure of the elements of information in a particular story (a simple example might be: introduce characters, set up scenario, present an anomaly/problem, resolve problem, present effect on characters, conclude).

A third dimension is the mood induced by the information. One characteristic of this is whether the receiver is stimulated to move away from or towards the information source, and how strongly. This dimension can perhaps be most easily measured in terms of valence (pleasant versus unpleasant) and arousal (level of activation).

We see presence level induced by a communication as a potentially useful fourth dimension. This is characterized as the level of interpretation needed cognitively to deal with information, and can be partially specified in terms of cognitive load. By our view, cognitive load will tend to be inversely related to the level of presence

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experienced, since it is a reflection of the abstractness of a medium. But locus of attention is another important factor.

Table 2. Four Dimensions of Communication

	Measurement	Characteristic
1. Information carried	Reducing uncertainty in bits	Redundancy
2. Telling a story	Structural characterization	Fictional or factual narrative
3. Mood induced	Valence and arousal	Action or inaction Attraction or repulsion
4. Presence level	Cognitive load and focus (inside-outside)	Level(s) of interpretation (internal-external focus)

While high cognitive loads will interfere more with other types of attentional task than low cognitive loads, two perceptual (potentially presence-evoking) tasks will interfere with each other even though each imposes a relatively low cognitive load. In other words, presence cannot be viewed as a simple result of redundancy. A concrete, perceptual presentation of information - say an animation that portrays a simple narrative - will interfere less with other more abstract tasks than, say, a textual description. But if the individual is already focusing her attention on the external world, as when driving, there will be a conflict between the one perceptual task and the other.

The appropriate level of mediated presence thus depends on both internal and external factors, on what the observer is thinking, but also on what she is perceiving and doing in any external world or worlds.

4.5 Communicational Context, Presence and the Person

4.5.1 Communication Forms in Relation to the Communicative Context

Communication plays an essential part in today's society, and much communication now takes place via different kinds of media, such as telephones, email, chat, text messages or traditional mail letters. The most expressive way to communicate, however, is through person to person contact, where the sender and receiver are in the same physical space. When this is the case the communication is conducted via several senses, including the words used, facial and postural expressions, the intonation and speed of the speech and so on. In most mediated communication there is a much greater potential for misunderstandings and misinterpretations due to the lack of the expressions via multiple senses. In other words, presence in communication reduces the potential for misunderstandings.

But high presence requires and demands a high level of attention. Depending on the context in which communication is taking place, this may or may not be appropriate. For example, most mobile phone applications should not demand much attention, since the user is often engaged in other activities concurrently. In contrast,

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when one is separated from a loved one and wants to communicate richly, the highest possible level of presence may be preferred - by, for example, including sight, sound, tactile feedback, and perhaps even aroma.

An important feature of modern communication patterns is their lack of symmetry. By this, we mean that the different partners in a communication are often in different physical situations, which may have very different characteristics. And increasingly, they may be using different types of communication device. In two completely different situations the same message could be interpreted very differently.

For example, imagine one person waiting for a flight, who receives a text message from a loved one as he is waiting. He has plenty of time to compose a heartfelt reply, but starts his message with a playfully provocative remark. As he is about to respond further, he hears an announcement to the effect that his flight is actually at a different gate, quite some way away. He realizes he will have to move quickly to get to the gate in time. But he has no time to finish the SMS he is writing, nor even to explain his current urgent problem. Because he was expected to be in contact before catching the long flight, he sends the partially composed SMS and sets off for the correct gate. But the receiver, unaware of the context in which the message was composed, completely misunderstands the sender's intent and is offended by the communication.

The above problem could potentially be addressed in several ways, taking account of both presence and the potential for monitoring emotional responses. A communication medium with greater presence would make the problem less likely to arise. By definition, more presence evoked by a communication form means more information about the present situation external to a sender is being transmitted. In a phone message, for example, the sender could explain the situation more quickly, while dashing to the correct location. And perhaps more importantly, the sender would also receive indications of the sender's true state, through paralinguistic cues such as breathing style, intonation, pitch and so on, as well as acoustic information from the surroundings. When video capability is also available, this tendency will be further enhanced, through the availability of facial expressions, visual features of the surroundings, and so on.

A different approach would be to use sensor technology to monitor the sender's physiological state directly. Such information could be presented to the receiver in a variety of different forms, and transmitted as an attachment to any form of communication. Although, in this case, the text message would be the same, the attachment would convey the fact that the sender was in an agitated state at the time the message was sent.

State-sensitive communication devices seem a promising way to cater for the fact that different individuals prefer different levels of presence. This may be because of the personal characteristics of the person concerned, which we discuss further in subsection 4.5.2, below. Contextual factors will also affect a person's state, and one of the most useful ways of tracking context may be through tracking the person's state, although without also tracking physical context this is open to misinterpretation and could be potentially hazardous.

4.5.2 Communication, Presence and the Individual

Since presence is, for us, a reflection of the extent to which an individual is engaged with (and feels able to act in) an external world rather than with an internally

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modeled world, we would expect personality factors that are known to affect this relation to also affect experienced presence. For example, we might expect that extrovert personalities in general experience higher presence than introvert personalities. Similarly, elderly people might be expected to experience less presence in common situations than the young.

Although relatively little work has been carried out in this area, there is some evidence to support our conjectures. Laarni et al. [25] present evidence of a positive relationship between experienced presence and extraversion, impulsivity and self-transcendence. Since Eysenck's [26] characterization of the extrovert was of a person who was predominantly engaged with events in the external world, rather than the internal world of thoughts and imaginings, this is to be expected from our own view of presence as a focus on action in the present, external environment. The same is true of impulsivity, since according to Laarni et al. [25] impulsive individuals are better able to shift their attention in external space. And it has been previously suggested that the highest levels of presence are associated with self-transcendence, with a loss of self consciousness (e.g. [6, 27]).

This is not to say that individual differences in imaginative skill do not predict the tendency to feel presence, to some extent, as Sas and O'Hare [28] suggested. They conclude that "the more users think, feel and act in the remote world [.....] the greater the sense of presence they will experience" (page 535). And, clearly, we do not really act in imagined worlds. Indeed, the point of imagination can be seen as the testing of possible actions without carrying them out [12].

The more general concept of absorption: a characteristic of the individual that involves an openness to experience emotional and cognitive alterations across a variety of situations [29], also seems to be important in predicting the tendency to experience presence. Both presence and absence can be seen as absorption states, the former based around the current perceptual flow, the latter around imagined events and situations. This may explain the suggested relationship between the tendency to experience presence and hypnotic suggestibility [28].

In our view, hypnotic suggestibility should be related to a tendency to experience either intense presence or intense absence or, more likely, both. The absorption state underlying hypnosis can be seen as a focusing of attention on a single object (and in such a state duration seems to stretch - time "stands still"; [20, 30]). But since this single object of attention may be internal or external, the state may result in extreme presence *or* absence.

We suggest a tentative set of individual characteristics and states that we would expect to be associated with high presence, and another set associated with relatively low presence, as set out in Table 3. An important implication of these differences is that communication forms will have differing impacts on individuals with different personalities, or in differing states (and personality can to at least some extent be seen as a tendency to be in certain states).

From these differences follow a large set of possibilities for misunderstandings and miscommunications through existing communication media such as e-mails, phone calls, text messages and traditional letters. Many people are uncomfortable with phone conversations and prefer less immediate and personal forms such as e-mails. But e-mails are often misinterpreted, especially in terms of the attitude or intentions of the sender. Conversely, there is a set of people who prefer phone calls, and this is likely to be related to a preference for less abstract communication forms - and less abstract forms by our account will tend to evoke more presence. Another important

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factor is whether a communication form is *synchronous* or *asynchronous*, and this will also vary between individuals and also situations. When the variation is between individuals, this may reflect preferences for specific *rates* of information exchange, amongst other things. By our definition, a communication form that elicits more presence will be slower than one which elicits less.

Table 3. Presence in Relation to Personal Characteristics and States (tentative)

Low Presence	High Presence
Old	Young
Awareness of themes, stories	Awareness of perceptual details
Sensory deprivation	Rich sensory stimulation
Introversion	Extroversion
Depression	Mania
Sedatives, alcohol	Stimulants, psychedelics
High error on vigilance task	Low error on vigilance tasks
Infrequent stimulus sampling	Frequent stimulus sampling
Long reaction times	Short reaction times
Ideological bias	Experiential bias

With existing media, the form is largely fixed. And in synchronous communications this means that the rate of information exchange is also largely fixed. In the following subsection we discuss the potential for creating new types of communication technology offering adjustable degrees of presence in use.

4.5.3 *Designing for Adaptable Asymmetric Presence in Interpersonal Communication*

By the three-layer, evolutionary account of presence [6] discussed in Paragraph 2 a typical, unexceptional level of presence arises from a split of attentional resources between layers of differing content, with some attention being directed to the current external situation and some to a different internal concern. Minimal presence, as we have suggested, results from an almost complete lack of integration of the three layers, such as is the case when attention is mostly directed towards contents of extended consciousness unrelated to the present external environment. By the same reasoning, maximal presence arises when proto consciousness, core consciousness and extended consciousness are focused on the same external situation or activity. Maximal presence thus results from the combination of all three layers with an abnormally tight focus on the same content (see Figure 5). Different ways of designing for maximal presence are outlined in [6].

Here we are concerned with designing communication devices for *appropriate* presence, rather than maximal presence. What is appropriate may depend on several

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factors, including the user's personality, her current contextual situation and purpose in using the device, and perhaps her internal state. We envisage a future in which the presence level induced by a communication is selectable, either deliberately by a communicant, or automatically by the device itself.

Imagine a headset conveying information to the eyes and ears, used for a variety of communicative functions, including messaging, telephone calls and conferencing. According to user choice or system sensitivity to context, the presence level could be adjusted to take account of the wearer's external situation and internal state.

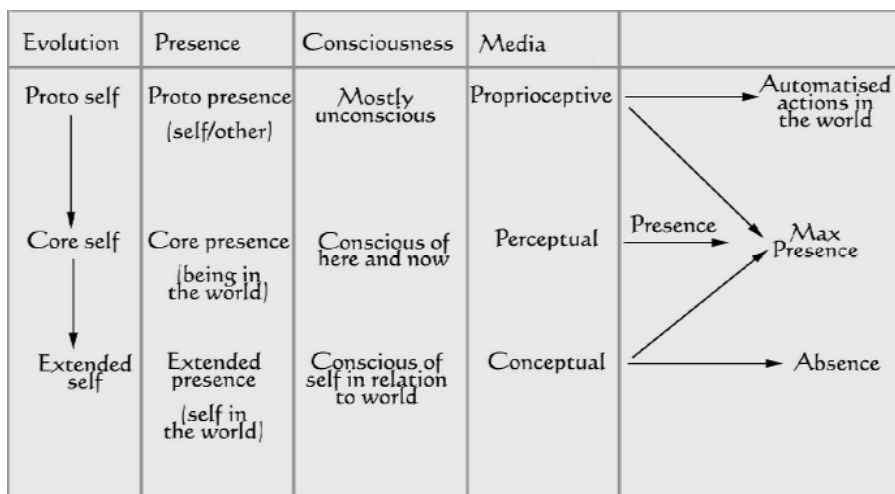


Figure 5. Layers, media and mental states (from [6], with permission)

Adjusting the presence level would effectively amount to including more or fewer of the three layers shown in Figure 5. A mostly conceptual media form would yield low levels of presence which would permit the receiver to also attend to perceptual events in her surroundings, and to carry out actions not related to the communication. A person listening to a recorded message on a hands-free mobile phone while simultaneously selecting grocery at the local store is one example of this. At the other end of the spectrum, participating in a distributed virtual reality in which one interacts in an embodied way, via gestures, speech, and so on, would tend to demand such a high level of presence that no other activities would be possible.

Currently available, low-cost sensor technology brings the realistic possibility of a wearable system that can detect physiological (and thus emotional) state, and use this to adjust the form of the communication. Existing work on detection includes functioning systems such as Thought Technologies' Procomp family, Mindmedia's Nexus device, and BodyMedia's SenseWear system. Any such system would probably need the ability to learn the responses of its wearer to set the presence level appropriately. Low-cost interaction devices that are sensitive to breathing and body orientation also already exist, for example our own "Body Joystick" interface [16]. The trend is likely to be for more asymmetry in communication forms, with each participant likely to have a personalized way of sending and receiving communications (and these need not be the same). Level of presence needed or preferred by a particular person in a specific context is a potentially important component of this trend.

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Increasing presence, though, need not always be a function of widening the communicational bandwidth. What is communicated may be abstract, but its realization could be highly concrete. Virtual realization allows the possibility for simulating a richly presence-inducing form from a highly abstract communication. We thus see two ways in which communicational presence can be adapted: by moderating bandwidth and by modifying the richness of virtual realization. This reflects the fact that presence may be enhanced by richer access to physical *or* virtual reality, even though the latter may be largely fictional. We can envisage a time when communicants may choose not only how rich a form their side of a communication may take, but also the extent to which the form reflects physical reality versus fiction.

Although presence arose as a feeling enabling the discrimination of the internal and imagined from the external and physical, new media allow the imagined to be rendered as external. Currently, the presence mechanism allows us to distinguish the physical from the virtual, because of technical limitations in virtual realization. But as the technology continues to improve, to the point that all three layers of presence are accurately addressed, we will have no psychological means to separate the physical from the virtual. A technology-based solution will then be required.

4.6 Conclusions

The level of presence invoked by, or required for understanding, a given medium is an important dimension of communicating through that medium. The presence parameter may vary according to several factors, including the available technology, the required use, and the context of such use. Individual factors such as personality will also impact on the ease with which different levels of presence can be induced, and also their desirability.

We have related these factors to what we consider to be a plausible model of the origins of the human presence mechanism and its current psychological function as a faculty for internal-external discrimination. We have also discussed possible inter-relationships between psychological, social and cultural aspects of viewing presence as a dimension of communication. Our overall aim has been to show how presence forms an essential element of our relationship with information, whether this resides - or is - the physical world or a virtual environment specifically designed for communication. Viewing presence a dimension of communication also sheds light on a variety of ways in which people may have differing experiences - of each other and of the world around them - even when apparently communicating efficiently.

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