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Expertise and becoming conscious of something

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ABSTRACT

Becoming conscious refers to how new mental content emerges in the mind. To understand this phenomenon, we studied how people experience graffiti by thinking aloud. In protocols, we found three types of becoming conscious: experiencing emotional and perceptual content directly linked to a perceivable object, non-perceivable or apperceived information content, and transformation and restructuring processes. On the grounds of the content-based study of protocols, we suggest that people can become conscious of either direct perception, apperception, or restructuring thinking. Research of the mind, which is grounded in analysis and explained by properties of mental content, can be called *content-based thinking* or *content-based psychology*.

1. Introduction

When a creature experiences something, internal and external information are processed in the creature's mind, resulting in mental representations of the ongoing action and the surrounding world as mental information content that is experienced subjectively and consciously as a unified and coherent phenomenon and which is understood, felt, and acted upon in some particular way (Lycan, 2012; Revonsuo, 2010; Saariluoma, 1995, 1997, 2001). Thus, consciousness has information content or mental content (Allport, 1980; Fodor, 1992). One could even say that consciousness is precisely the information a person consciously experiences at any moment. Thus, the information content of consciousness is the content of human experience (Saariluoma, 1995, 2001).

A crucial moment in the human mental process involves becoming conscious of something. A moment earlier, an idea about something is not present in the conscious mind, but a moment later, this idea becomes the focus of conscious thinking. Classic empirical examples of such transitions are insight and restructuring (Köhler, 1957; Wertheimer, 1945). As "becoming conscious of" is intuitively an important process in the human mind, we study the mental processes involved in this phenomenon.

Scientific research aims to analyse and explain given phenomena. This is familiar to all researchers. However, it still makes sense to explore the right level of analysis and the right way to form explanatory grounds in the study of becoming conscious of. *Explaining* means providing an answer to how- and why-questions such as "How things can be as they are?" and "Why are things as they are?" (Hempel, 1965; Saariluoma, 1997). In such work, it is important to find explanatory grounds, that is, what kind of known phenomena can be used to make the structure and origins of studied phenomena conceivable (Hempel, 1965; Revonsuo, 2010; Saariluoma, 1997, 2003, 2005).

Mental representations and information in them have been the foundational concepts in discussing any mental phenomenon when investigating human cognition and thinking (Allport, 1980; Anderson, 1983; Chalmers, 2010; Fodor, 1992; Neisser, 1976; Newell & Simon, 1972). Becoming conscious of something can thus, mean obtaining new conscious information about a topic in mental representations. If there is no required information in a mental representation, one cannot be conscious of it. Hence, *becoming conscious of something* means getting the relevant information in the contents of conscious and subconscious mental representations.

One important psychological phenomenon that can provide an understanding of learned mental contents, their representations, and relevant mental processes is expertise. Experts are known to encode better domain specific situations. For example, medical doctors experience their patients differently than laypeople do. In other words, doctors have different mental information contents than laypeople do. Doctors can ask about symptoms, examine laboratory results such as X-ray pictures and make, based on given information, specific caretaking decisions. At the same time, patients can also see this same information but have no idea what it means or what should be done in the situation. Doctors, as well as all experts in their domains, can be aware of things which are obscure to laypeople. Here, we argue that this everyday phenomenon introduces a new way of considering human conscious awareness and mental experiences. It makes it possible for researchers to

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analyse and understand the role of mental contents in the process of becoming conscious of something.

Expertise is an acquired or learned domain-specific skill (Ericsson, 2006). Consequently, expertise studies may provide a good means of studying the phenomenon of becoming conscious of information (Ericsson, 2006; Saariluoma, 1995). However, it is also essential to ask here, how collected information by comparing experts and novices should be analysed to improve our understanding on what is the process of "becoming conscious of something" like and how can we explain this phenomenon.

Studies on experts' thinking have unveiled phenomena relevant to our present work. First, experts "see" things that novices cannot perceive (de Groot, 1965; Saariluoma, 1995). For example, an art critic may see brush strokes in a painting which are typical for a particular artist or style, but a person without expertise in art will be unable to note such things (Collins & Evans, 2007; O'Connor, 2004). Secondly, experts' thinking fluctuates from one piece of content to another (de Groot, 1965; Saariluoma, 1995). In initial stages, subjects in problem-solving experiments cannot "see" or experience a solution, which later becomes clear (Duncker, 1945; de Groot, 1965; Newell & Simon, 1972; Saariluoma, 1995; Wertheimer, 1945). If the given pieces of tradition are collected into one solution, it is possible to outline a solution to the problem of how we can investigate the information contents of experiences (Saariluoma, 1995, 1999). The core idea is to analyse what a particular piece of mental content can explain about some aspect of human action (or goal-directed behaviour). For example, chess players' search for a solution is limited to a few moves, while computer programmes investigate hundreds of thousands of variations in a second (de Groot, 1965). It is empirically possible to show that the contents of a few tacit "grammatical" rules explain the limits of chess players' thoughts (Saariluoma, 1995). This means that information content can explain the phenomenon of limited searching or more broadly, the difference between senseless brute searching and relevance-based human thinking.

Expertise can thus be used to study mental content (Fodor, 1992; Saariluoma, 1990). Historically, mental content has mainly been discussed after Kant (1781/1976) by phenomenologists (Husserl, 1901−2). However, from a psychological perspective, phenomenological research has been subjective and therefore, introspectionist. Experimental psychologists have seldom adopted the works of phenomenologists (Watson, 1918). Yet, one could analyse mental contents from a third-person perspective by studying the contents of human speech and verbal behaviour. This stance has often been called the *heterophenomenological analysis of consciousness*, (or a third person view to experience) (Dennett, 1993; Ericsson & Simon, 1984; Newell & Simon, 1972). In clinical psychology, researchers have done a lot of work over the years to develop paradigms for investigating conscious and subconscious mental content (Ellenberger, 1970).

A good example of third-person studies in conscious experience is a protocol analysis of human problem-solving processes (Duncker, 1945; de Groot, 1965; Ericsson & Simon, 1984; Saariluoma, 1995). Our main idea is that the psychological analysis and argumentation concerning human action or mental representations and pursuing to explain phenomena related to them should be based on the properties of mental content or information content in mental representations. Unlike many schemas, production systems associative networks, and mental model-based studies (Anderson, 1983; Fodor, 1992; Johnson-Laird & Byrne, 1991; Neisser, 1976; Newell & Simon, 1972), we want to build our arguments on the contents of mental representations expressed in subject protocols.

Instead of arguing that the number of schemas or mental models in the minds of people explain that people make errors, for example (Johnson-Laird & Byrne, 1991), one can also call (as we do here) attention to the information contents of the schemas or mental models. One can empirically argue that people have incorrect or biased mental contents that explains why they err. The two ways of looking mental models are not contradictor but complementary (Saariluoma, 2001). We take information contents of mental representations in a concrete manner and analyse mind and explain given psychological phenomena on the grounds of the *contents* of mental contents.

The main empirical problem will be to study how the mental contents and the process of becoming conscious of a phenomenon (or seeing something as something) differ between expertise groups (Saariluoma, 2001). Instead of presenting a specific hypothesis here, we want to proceed in line with Glaser and Strauss's (1967) grounded theory. Protocols can give us an understanding of how information content in disparate groups works (Duncker, 1945; de Groot, 1965; Ericsson & Simon, 1984). We simply ask: what are the similarities and differences in the representational contents in which people with various expertise experience works of art? Can experts become conscious of something that novices are not able to represent or consciously experience?

The main characteristics of our approach to the contents of experience are outlined as follows. First, we aim to study the effects of learning on the interaction with the environment. This can be achieved by studying the effects of expertise on experience. Second, we collect protocols providing information about the contents of experiences (Newell & Simon, 1972; Saariluoma, 1995). Third, we define the phenomena to be explained and finally, explicate explanatory features of mental contents in protocols.

Our *content-based* approach has common ground points with information processing systems (Newell & Simon, 1972), production systems (Anderson, 1983), schema theories (Neisser, 1976), RTM (Fodor, 1992) and 4E (Clark, 2012; Johnson, 2015). These approaches begin with the idea that people represent world in their minds. However, our thinking is different as we take one step forward. Instead of focusing our argumentation on information on general levels, i.e., information as information, we base our thinking on the contents of represented information, i.e., mental contents. Our analysis of data is based on contents of information in protocols and thus also in mental representations. Moreover, we ground our arguments and explanations on the properties of these information contents. On these grounds we call our approach *content-based cognitive science or content-based psychology*.

2. Methods

Expertise is always domain-specific. Here, our chosen domain is art (Combrich, 1989; Solso, 1996). We study how experts and educated laypeople diverge in their thinking. Our focus will be the fluctuation in contents and expertise-based distinctions when subjects relate what they experience in looking at graffiti art.

2.1. Participants

In the experiment, the participants thought aloud about their perceptions of four graffiti and one mural. N = 19 participants (8 female, 11 male; age range: 13–63, mean age: 36.6 years) were recruited using an ad on the Demolition Art Project (2020) Facebook page and flyers posted on the research location walls in Kerava. All participants were voluntary subjects, and all of them gave verbal consent. Participants were compensated with one movie theatre ticket for their participation.

2.2. Methods

Before the experiment, the participants were asked to describe their knowledge of and possible active participation with graffiti and street art, and their levels of expertise in graffiti were assessed on a scale of one to four: 1) does not know anything about graffiti (N = 3); 2) knows little about graffiti (N = 4); 3) knows something or a lot about graffiti but does not do graffiti (N = 4); and 4) knows a lot about graffiti and does graffiti (N = 8). Laypeople were described as those with scores of one or two, and those with scores of four formed the group of experts. Two participants with scores of three were classified as laypeople, and two were classified as experts based on their knowledge and past experiences with

graffiti. Finally, there were two groups: *laypeople* (N = 9) and *experts* (N = 10). Here, experts did not have to have experience with actively producing graffiti because just like art critics, they might still have an adequate understanding of the technical and procedural skills and knowledge that are required to produce graffiti (Collins & Evans, 2007).

2.3. Materials and procedure

The experiment was held from July to August 2016. Several graffiti and murals were painted inside and outside of the building during the Demolition Art Project (2020). The number of participants was limited because the exhibition (research material) was only available for a limited amount of time. Participants used a handheld audio recording device to record their thinking-aloud during the experiment. All assessed works were inside the Petteri main building and were located within approximately 50 m (walking distance) of each other. Four graffiti works and one mural, representative of a variety of styles, from round or angular letters to works with representative characters, were selected by the researcher in order to produce observable distinctions as well as coherence in the participants' assessments. An example of the graffiti stimulus is presented in Fig. 1.

Some participants had seen at least part of the works before, but for some, they were completely new.

The experimental design was a within-subjects design that included semi-structured interviews. Each participant was individually interviewed. After their expertise in graffiti was assessed, participants were instructed to say anything that came to mind. After the instructions, the experimenter walked with the participant to the first selected work and asked the following interview questions:

1. What kinds of thoughts does the work evoke?
2. What kinds of emotions does the work evoke?
3. What kinds of meanings or stories do the work evoke?
4. Is the work beautiful, ugly, or something else?
5. What about the work's style and colours?
6. What draws attention in the work?
7. Where can you imagine the work to be located?
8. Is the work art?

All participants were presented with the same five works in the same order and asked the same interview questions at each work.

3. Results and discussion

In order to give readers a good understanding of the different types of mental contents, we present the qualitative aspects of the results and then investigate the quantifiable differences between the subject groups.

3.1. Basics of analysis

The thinking-aloud audio recordings were transcribed into text for the data analysis. Data were analysed using a mixture of thematic analysis and content analysis (*applied thematic analysis*), which is a synthesis of different techniques (Glaser & Strauss, 1967; Guest et al., 2012). While thematic analysis provides a technique that aims to preserve the deeper meaning within the discourse in the analysed text, content analysis provides a means to extract quantifiable and structured data and ensure higher objectivity towards the analysed text (Guest et al., 2012). Data were analysed using Microsoft Excel Version 16.41 software and IBM SPSS Statistics Version 26 software.

The data analysis for content categories and high-level themes included four phases. During the first phase, initial categories, themes, and their recording units as codes were defined. Words, phrases, and idioms that participants used to describe the mental content while viewing the selected artworks and that constituted semantic units as codes for categories were recorded. Semantic units were understood as conceptual units that consist of either single words or longer phrases depending on the analysed block of text. One sentence may include multiple semantic units, or several sentences may include just one semantic unit. The analysis is based on direct verbalised statements in protocols, not a researcher's reviewed interpretations of them (see e.g., Ericsson & Simon, 1993). This technique is appropriate for the research question: What types and how much of content can be found in protocols when participants of various expertise experience graffiti art? It is also important that the researcher who develops the coding has at least a rudimentary knowledge about graffiti (i.e., its culture, practices, techniques, and special vocabulary). The same word or phrase may mean

Fig. 1. An example of graffiti stimulus used in study.

different things in different contexts and for speakers with different backgrounds, there may be slang words or expert terms, subcultural references etc., so the researcher needs to know beforehand whether the protocol is given by a layperson or a graffiti expert to code and categorise protocols more correctly.

During the second phase of the analysis, the initial categorisation was critically evaluated and reconstructed as needed. In total, 4010 (1664 laypeople and 2346 experts) semantic units were coded from the data. This phase resulted in 30 types of content. Following ideas by Saariluoma (1990, 2005), Kuuva (2007) proposes that mental content in art experience can be divided into perceivable and non-perceivable content. Perceivable content includes semantic units of content that are about directly sensorily perceivable and emotionally felt content (Kuuva, 2007; Saariluoma, 1990, 2005). The second type of content includes learned conceptual information, emotional schemes, and mental models, for example, in the form of facts, analogies, and imagined meanings. These contents are not representable as sensory information (i.e., they could be non-perceivable) (Kuuva, 2007; Saariluoma, 1990, 2005). We used a similar type of categorisation that was used by Kuuva (2007) and divided the 30 produced types of mental content into two categories:

- *perceivable content:* background, characters, colours, emotions, faces, movement, shapes and forms, size, three-dimensionality
- *non-perceivable content:* analogies, artist's style, composition, cultural knowledge, graffiti artist, ideation, interest, letters, meaning for artist, meaning for laypeople, meaning for subculture, reading, skills, style, subjective ideation, subjective taste, subjective technique and doing, technical quality, technique and doing, tools, aesthetic value.

Because art experts are assumed to have acquired larger amounts and more complex non-perceivable knowledge and skills related to their specialised domain than laypeople (Collins & Evans, 2007; Kuuva, 2007; Stokes, 2014), it may be assumed that also in the case of graffiti art, people who have a lot of experience or knowledge related to graffiti possess more non-perceivable content about graffiti than laypeople. First, the protocol material was analysed using qualitative analysis to investigate mental content as distinct information types and structures in the conscious experience of laypeople and experts. Then, the mental content was analysed using quantitative methods to investigate whether there were statistically significant differences in the number of contents in different categories and the levels of expertise between laypeople and experts.

3.2. Qualitative analysis of information types

3.2.1. Immediately perceivable perceptions and emotions

Contents were categorised as perceivable or non-perceivable with 30 subcategories. However, protocols call further attention to distinct types of information content-wise. First, one can find references to phenomena that people can emotionally experience (Table 1).

In these examples, information content concerns immediate emotional experiences. They can be divided into basic attributes of emotional experience, that is, emotional intensity, emotional theme, valence, and action or motivation-related emotions or interests (Myllylä, 2020; Saariluoma, 2020). *Immediate* means what is present at this moment.

Table 1
Examples of immediate emotional encoding in protocols.

Emotions	Emotion contents	Examples
Descriptions related to felt emotions	Intensity	e.g., "very", "something emotional"
	Theme	e.g., "joy," "excitement," "gloomy,"
	Valence	"good," "bad," "neutral"
	Emotional motivation	Interest, e.g., "interesting," "boring," "I would like to know more"

The second important content type is directly perceived information content. One can say that immediate perceptual information content in protocols are features that, during the study of an artwork, can be received sensorily by spectators. Typical examples of perceived content are shapes, colours, directions, movements, objects, groups, and so on (Table 2).

Perceptual features or in philosophical terms, *sense data* or *perceptual qualia* (Aristotle, 1984, pp. 641–692; Russell, 1917), are elementary content in immediate perceptions. Examples in the present study are shapes and forms, colours, three dimensionality, size, movement, and objects, such as faces and composition.

3.2.2. Non-perceivable kinds

The two types of expressions are very keenly associated with the artwork and sensory emotional experiences related to the presented artwork. Our analysis led us to a new kind of expression, which is directly linked not to the artwork but rather, to what occupied the minds of the spectators before they saw the artwork. Thus, they are content that is not directly dependent on the stimuli.

Not every description of subjects' experiences had content that was visible. These expressions were remembrances, concepts, facts, and sociocultural content, also known as *knowledge content* (Table 3).

Spectators also created associations between the works and different cognitive and emotional models or schemas. These diverged from direct, primitive emotions and were non-perceivable contents construed by apperception. These types of content are referred to as *cognitive* and *emotional schemas* (Table 4).

Finally, a new type of expression was found. Instead of being static and based on primary or secondary representations (i.e., immediately represented emotions and perceptions or apperceived representations from knowledge or schemas), these remarks reflected changes in the information content of mental representations (Table 5).

The tables illustrate three types of becoming conscious. They are perceptual (Tables 1 and 2), apperceptive (Tables 3 and 4), and restructuring type of becoming conscious (Table 5)

3.3. Quantitative analysis of mental content

3.3.1. Mean frequencies of the content categories found in laypeople and experts

The mean values of the frequencies of perceivable and non-perceivable kinds of content categories in protocols of laypeople and experts are shown in Fig. 2.

A two-way factorial ANOVA was conducted on mean frequencies of the two types of mental content in participant protocols for two categories of contents (perceivable and non-perceivable contents) and for

Table 2
Examples of directly perceived content in protocols.

Perceptual properties	Perceived contents	Examples
Perceivable visual properties of the work	Three-dimensionality	e.g., "three-dimensional," "depth," "shadows"
	Characters	e.g., "a creature," "a parrot," "hands"
	Colours	e.g., "candy colours," "yellow," "bright"
	Composition	e.g., "composition," "balanced," "proportions"
	Facial features	e.g., "faces," "eyes," "human gaze"
	Movement	e.g., "going in the same direction," "dynamic," "flying"
	Shapes and forms	e.g., "pattern," "stars," "geometric"
	Size	e.g., "small," "massive," "10 m wide"

Table 3
Examples of non-perceivable knowledge content in protocols.

Knowledge	Knowledge content	Example
Learned concepts and personal experiences about subcultural artefacts, special terminology and semantic codes, beliefs, values and norms, sociohistorical stories and locations, information about artists, and styles as formal genres and conventions	Cultural knowledge and life experiences	e.g., "Graffiti is, at its basis, a thing that is made by men," "Pasila gallery".
	Graffiti artist	e.g., "The maker of this work apparently won the graffiti Finnish Championship competition this year," "he paints a lot," and "the artist is a woman"
	Graffiti artist's style	e.g., "very typical work for its artist," "you can recognise immediately from the style who has made it," and "own twist"
	Letters	e.g., "the middle letter," "m and k," "symbols"
	Reading	e.g., "it says, 'raw deal,'" "it reads something"
	Style	e.g., "abstract," "old-school piece," "Finnish wild style"
	Analogies to facts	e.g., "*Giger* type of art," "*Blade Runner*," "*Ghostbusters*"

Table 4
Examples of non-perceivable cognitive and emotional schemas in protocols.

Cognitive and emotional schemas	Non-artist/Laypeople	Artist/Expert
	"The orange background colour gives a joyful and perky impression. The character looks very amusing. The text part does not open up in any way." "This is also a bit mystical; I feel that would be some bad guy. Those eyes remind me of that, or when the upper part of the face is dark. Evil ambiance, not of the artwork, but because that guy is evil."	"It is beautiful. It is also a bit dangerous when I don't know what they are, a bit threatening. I don't know what they represent. That it is for sure always in the viewer's… that there is that space and those space tentacles. It is something living, something organic." "This conveys more that kind of mystical and exciting ambiance. The ambiance is a bit between these two previous ones. There is mysticality but also childishness and that kind of, how do I put it? Good mood environment beautification.

Table 5
Examples of changes in the information content of mental representations in protocols.

Changes in the information content of mental representations	Non-artist/Laypeople	Artist/Expert
	"Also, when I think about what the idea is here, what these things here are, it maybe makes me look at this more carefully. When walking by, one may notice the colouring first; then one may start to think what it is that is wanted to be said here and what this represents." "There is for sure some story in this because at least for me, it immediately comes to my mind that a story goes from one side to another. That would instantly create some meaning for me, not straight away, but I would like to look at this for longer and think about what that story is, what the artist has tried to tell, and… what it could tell me. Quite interesting."	"I appreciate that somebody can make those kinds, even though I myself cannot make that kind, and I am not familiar with that, a bit trivial. It is quite nice to look at that kind. I might not have been able to look at this if I hadn't stopped now to analyse this. It takes time to read up on this. That may be a rose… It probably is not a rose." "When we are in some space and there are many works in the same place, this is completely different and a different world than those others. One has to sigh and stop. The first one was easy to look at. It smiled at me, but this requires a lot of concentration."

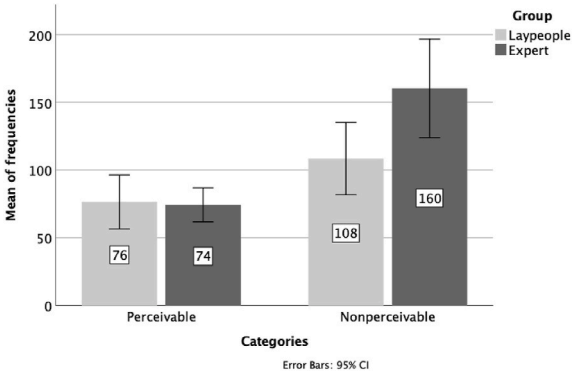

Fig. 2. The mean values of the frequencies for the two categories of mental content (perceivable and non-perceivable) in laypeople and experts.

two levels of expertise (laypeople, experts). There was a significant main effect of the level of expertise on frequencies of mental contents, $F(1, 34) = 4.84$, $p = .035$. There was a significant main effect of the categories of contents on frequencies of mental contents, $F(1, 34) = 27.29$, $p < .001$. There was a significant interaction between the level of expertise and the categories of contents, on frequencies of mental contents, $F(1, 34) = 5.71$, $p = .023$. This effect indicates that the perceivable type of contents and non-perceivable type of contents were affected differently by the level of expertise. This means that experts encode perceivable mental content similarly to novices but they encode non-perceivable information much better than laypeople.

An independent *t*-test was conducted on the mean of frequencies of perceivable content and on non-perceivable mental content of laypeople and experts. The results indicate that on average, laypeople had slightly more perceivable content ($M = 76.44$, $SE = 8.64$) than experts ($M = 74.30$, $SE = 5.54$). However, this difference, 2.14, 95% CI [−18.61, 20.06] was not significant $t(17) = 0.21$, $p = .834$. In case of non-perceivable content, the results indicate that on average, experts had more non-perceivable content ($M = 160.30$, $SE = 16.09$), than laypeople ($M = 108.44$, $SE = 11.59$). This difference, −51.86, 95% CI [−88.00, −13.90] was significant $t(17) = -2.56$, $p = .020$.

An independent *t*-test was also conducted for the 30 different types of mental contents to analyse whether there were statistically significant differences between the means of the frequencies of each type of content in laypeople and experts. The results indicate that on average, there were significant differences in means for six mental content types (*artist's style*, *graffiti artist*, *letters*, *style*, *subjective technique* and *technique)*. These statistically significant differences between the means of six mental content types in laypeople and experts are presented in Table 6.

4. Discussion of results

Protocols have traditionally been seen as descriptions of mental contents (Ericsson & Simon, 1984, pp. 50–52). Of course, spoken content does not provide an exhaustive description of mental representations; nonetheless, it is the best representation of mental contents. Here, we use the analysis of mental contents to separate types of content

Table 6
Results for independent t-tests indicate that there are statistically significant differences between the means of mental content types in laypeople and experts in six content subcategories.

Mental content	Laypeople ($N = 9$)		Experts ($N = 10$)		Statistical significance			
	M	*SE*	*M*	*SE*	Mean difference	95% CI	*t*(17)	*p*
Artist's style	1.44	0.63	7.80	1.24	−6.36	[-8.87, −3.69]	−4.43	<.001
Graffiti Artist	0.89	0.46	5.10	1.54	−4.21	[-7.65, −1.50]	−2.50	.023
Letters	3.89	0.98	10.90	2.03	−7.01	[-11.34, −2.97]	−3.00	.008
Style	11.33	1.70	20.40	3.25	−9.07	[-16.67, −2.33]	−2.39	.029
Subjective Technique	0.56	0.38	4.10	1.49	−3.54	[-6.94, −0.14]	−2.20	.042
Technique	6.44	0.80	11.20	1.44	−4.76	[-8.14, −1.94]	−2.80	.012

elements and to get a clearer picture of how people can have the kinds of mental content they have and be conscious of the kinds of things these contents are.

In the presented data, the first psychologically relevant type of mental content is emotional information. Joy, fun, and excitement were typical contents expressed by participants when they looked at certain works, whereas some works evoked emotional information such as mysticality, danger, and awe (Myllylä, 2020). It is also possible to classify subtypes of emotions such as themes (gloomy, admiration), intensity (neutral, very), valence (good, bad), and analogical or metaphorical modelling (robot-like, childish). Emotional evaluation is also similar to motivation or conation (interesting) and aesthetic analysis (magnificent).

Besides emotional content, subjects had a lot of cognitive content in their protocols. They first presented directly perceivable things. They referred to colours and forms that were directly visible (red, dark). They also referred to shapes, sizes, movements (going in the same direction), and forms (geometric, lines).

Emotional and perceptual information processing can be immediate experiences. What we mean by immediate does not mean that this type of information appears first chronologically in the experience; rather, it is present at the surface level of the experience. After noting the immediate elements of experiences, a researcher can pay attention to the protocol elements, which entail meanings and cultural patterns that exist within another level of experience but may appear within the experience at the same time as the direct information. Meaning can be associated with oneself, artists, spectators or cultures, and technical practices (Myllylä, 2021).

A direct representation of the perceivable world can be called a "primary representation." In our empirical material, primary representation entails materials that people can directly perceive, that is, materials that have representations on sensory surfaces (cf. e.g., Gibson, 1979; Neisser, 1976). Subjects also have secondary representations that entail emotional remembrances, meanings, conceptual, and memory content. The contents of secondary representation can have perceptual elements in interpreted forms such as "this is street art," "this is typical for its painter," or "has for sure planned this,", or unperceivable mental contents, such as electrons, infinite, eternity, "futuristic," (i.e., abstract things one cannot perceive) (Saariluoma, 1999; Thagard, 2012). They are memory information-enriched comments and conceptually concern what is perceived.

It is important to address one additional aspect of protocols: transitions from one content to another. The transformations of encoded representations, or *insight*, are consequences of human thinking. People learn to modify their representations with new information content (Fisher, 1998).

In our empirical study, we found that both laypeople and experts had similar types of mental contents, but the *amount* of these contents varied. All people are immediately connected to the surface of reality by their perceptions in somewhat similar ways, but as people gain expertise in a domain (in this case, graffiti), they also gain more non-perceptual information content about that domain, which is present in their mental representations in conscious experiences.

On summarising the interpretation of empirical results, we can claim that the contents of mental representations are encoded in two states. First, perceptual and emotional systems provide immediate information about objects. Second, conceptual and memory systems enrich perceptual representations or generate images or conceptual contents with no direct link to any perceptual information. The constructed secondary representations are transformed by thinking. This can be seen as a result of what may be called, in Piaget's (1999) terms, *formal thought operations* or metacognitive "*thinking about thinking*" (Fisher, 1998), like reflexive thinking or metamentation (Bogdan, 2000) and reflective consciousness (Revonsuo, 2010). Reflection can create new representations with new information content.

The analysis leads to a three-process model for investigating how people can become conscious of a phenomenon. A three-process model for "becoming conscious of" is presented in Fig. 3.

First, perceptual operations associate people with the external environment. This information is represented on sensory receptor surfaces. Second, memory information, concepts, and learned emotional schemas and mental models give non-perceptual and non-perceivable information content that enriches interpreted information content in mental representations. Finally, thinking modifies apperceived representations into new forms, introducing new ways of experiencing the external world. *Restructuring* and insight are traditional names for transformations of information content in mental representations (Duncker, 1945; Gick & Holyoak, 1980; Köhler, 1957; Saariluoma, 1995; Wertheimer, 1945).

Our results suggest that there are three kinds of processes in

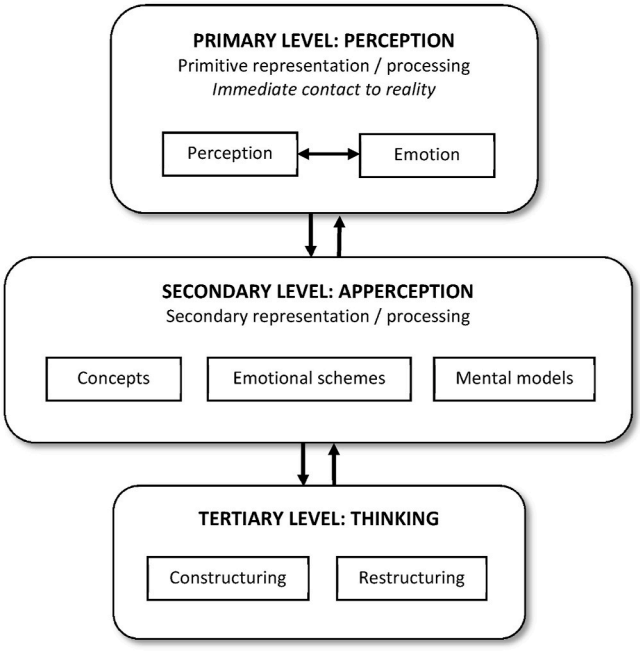

Fig. 3. A three-process model for "becoming conscious of".

becoming conscious. First, there is immediate emotional and perceptual encoding, called *perception*. Second, there is the enrichment process, in which inborn and learned concepts enrich information into experienced information content. This process, we call *apperception* (Husserl, 1901−2; Kant, 1781/1976; Stout, 1896). Finally, restructuring processes enable people to reorganise their conceptions into new ones and to become conscious of restructured mental content.

5. General discussion

The problem of *becoming conscious of something* opens its own perspective into the human mind. Knowing something about something is an issue concerning mental content. One cannot be conscious unless one is conscious about something, and this something is information content in the mind. For example, people have for centuries looked how masts arise before the ships over the horizon, but only in the 16th century they have become conscious of the role of the form of earth in understanding the phenomenon (Hanson, 1958; Wertheimer, 1945). Thus, investigating becoming conscious of is worth effort as it opens the way to the psychology of innovation.

To analyse the problem of becoming conscious, it is essential to take a new metascientific point of view and study the basic concepts and the explanatory grounds used in the research in consciousness and conscious experiences. Thus, to outline the main novelty of content-based psychological thinking, we briefly overview some related ways of approaching mind.

A great deal of modern cognitive psychology and science is based on idea that people are limited capacity information processing systems (Anderson, 1983; Broadbent, 1958; Johnson-Laird & Byrne, 1991; Miller, 1956; Newell & Simon, 1972; Saariluoma, 1997). Consequently, explaining various issues, such as failures in human action, is grounded on the idea that tasks' demands surpass the limits of human information processing (e.g., attention or working memory) (Saariluoma, 1997). However, our approach deviates essentially from the tradition in this regard. Instead of limited capacity, we base our analysis on the information content of mental representations or mental contents (Saariluoma, 1992). It is essential here to understand the difference between content-based thinking and capacity-based thinking.

In our research, we empirically found three mental processes of becoming conscious. The first was the processing of emotional-perceptual consciousness, characterised by emotional and sensory representational content and direct contact with the perceived environment. This is the level of immediate and stimulus-dependent encoding. Second, mental representations had information content that could not be perceived at all. This is why it makes sense, when analysing mental content, to differentiate perception from apperception (Husserl, 1901−2; Kant, 1781/1976; Saariluoma, 1990, 1995; Stout, 1896). Perceptual content is available to all but conceptual encodings require learned information.

Finally, the information contents of mental representations in the study were dynamic. People represent the world and stimuli in one way in a given moment and in another way at a different moment. The change from one representational content to another always means a change from becoming conscious of something to becoming conscious of another thing. It often also means a change from one emotional state to another. When analysing mental content, we suggested the three-process model of becoming conscious of information content.

However, our ultimate goal was to investigate how becoming conscious of could be studied in modern psychology and cognitive science. Intuitively, becoming conscious of is one of the most common events in the human mental process. It is present all the time in human information processing. For this reason, it made sense to specifically study the conceptual foundations of this type of research.

There is a great deal of documentary material in which one can see how different people experience works of art. They can mostly be classified as art history or interpretations of works of art (e.g., Hagen and Hagen, 2003). From a cognitive scientific and psychological perspective, different analyses normally illustrate what kinds of information content people have experienced and become conscious of. Our work has focused on an empirical analysis of the kinds of mental contents and processes that are typical for encoding and experiencing works of art and in a broader sense, any information in one's environment. A similar pattern can also be found in chess expertise (Saariluoma, 1990).

In the philosophy and psychology of the mind, mental contents have been discussed among phenomenologists (Husserl, 1901−2) and analytic language philosophers such as Wittgenstein (1953), Austin (1975), and other ordinary language philosophers (Passmore, 1957; Ryle, 1949; Wisdom, 1956). More recently, Fodor (1992) and others have highlighted mental content and the analysis of representations (Crane, 1992, 2014; Lowe, 2000; McGinn, 1989; Peacocke, 2014; Thomas, 1999; Tye, 2000). Mental content in experience has also been a topic in more recent scholarly discussions (Chalmers, 2010; Egan, 2014; MacPherson, 2011, 2012; Montague, 2016; O'Brien, 2009; Siegel, 2017). However, one cannot say that mental contents would have belonged more to the mainstream cognitive analysis of the mind compared to capacity-based thinking (Saariluoma, 1995, 1997).

In clinical psychology, the contents of mental contents have been studied occasionally. Freud (1917/2000) made a difference between libido, I (Ich), and super I (Ueber Ich). Jung (1991) discussed such content-oriented phenomena as life world (Lebenswelt) and archetypes. Beck (1975) also noted the role of negative mental contents in depression. These are all examples of investigating the mind in terms of mental contents. Moreover, in developmental psychology, Piaget (1970) used important differences between accommodation and assimilation or moral analysis on properties of contents. Newell and Simon (1972) spoke of content-oriented thinking in simulating human thinking. In addition, the psychologists of thinking, such as Köhler (1917/1957) and Kahnemann (2011) studied restructuring and reflective processing (see also Duncker, 1945; Saariluoma, 1995; Wertheimer, 1945). Nevertheless, it has not been common to extensively base the analysis of mind and actions on the properties of mental contents.

One important explanatory ground for consciousness research has been introduced by biology and neuroscience (Chalmers, 1995, 2010; Revonsuo, 2010). Consciousness research is linked to the neural analysis of representations, which is a necessary condition for the mental representation of information content (Rolls, 2000; Swaab, 2014). There are no mental contents that can exist outside the nervous system. Neural processes should not be considered free from content either. Evidently, many neural sub-systems, such as colour vision, are content specific and specific to some aspects of mental content (Allport, 1980; Minsky, 1986; Tononi & Koch, 2015; Tononi et al., 2016). Indeed, one can speak about content-specific neural modules or faculties (Allport, 1980; Fodor, 1983; Minsky, 1986).

However, neural processes cannot effectively and exhaustively explain phenomena such as information contents in mental representations. The analysis of experts' thinking shows that mental contents are learned. For example, being able to encode green colour in a painting does not mean that one would know why and what kinds of greens van Gogh used or why he used a particular green in a particular painting. Neural theories can clarify necessary conditions for mental contents and people's representations with disparate contents, but they do not provide an understanding of why people have mental contents and what kinds of mental contents they have (Saariluoma, 1999).

Finally, 4E cognition (embodied, embedded, enactive and extended) (Clark, 2012; Johnson, 2015; Newen et al., 2018) is still another approach, which is partly overlapping with our thinking. However, in this manifold approach the focus is not in the contents of information people rely on in their action. Thus, our thinking is different from 4E as our way of thinking is focused on the contents of mental contents.

The main problem in using neural concepts to investigate representational information contents in the mind is the necessary openness and modifiability of the brain as a system. The brain must be able to learn the

contents required in different actions. Chess players' knowledge of chess is different in content from artists' knowledge of art. The mental contents of such differences cannot be studied at the brain level as chess players and artists have different learning and life histories, which make their expertise different. The differences are manifested in the contents of learned information, not in the learning brains. The analysis of the mind, which is based on the analysis of mental contents, can be called *the content-based cognitive science or content-based psychology* (Saariluoma, 1997, 1999, 2001).

We have, in this paper highlighted the notion and phenomenon of mental content as an analytical and explanatory category in investigating the phenomenon of becoming conscious of. The analysis and explanation of human actions based on representational or mental contents introduces a new way of examining consciousness. The properties of mental contents (i.e., the information contents in mental representations) form the starting point for content-based thinking. Instead of discussing the contents of mental representations on a general level in schemes, priming, mental models, or productions, we have focused on the properties of contents in protocols to highlight the three-process model of becoming conscious. Hence, differently from the earlier representational theories (e.g., Allport, 1980; Fodor, 1992; Rescorla, 2020), we have studied "contents as contents." One could characterize our approach as content-based referring to the idea of explaining human actions on the ground of properties of information or basing the explanation on the contents of information contents in mental representations.

Author statement

Mari Myllylä: Conceptualization, Methodology, Formal Analysis, Investigation, Writing of the Manuscript, Visualization. **Pertti Saariluoma:** Conceptualization, Methodology, Writing of the Manuscript. This is an equal authorship paper.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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