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## **How do we make sense of significance?**

*Indications and reflections on an experiment*

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1 Title page

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3 Title:

4 **How do we make sense of significance? Indications and reflections on an**  
5 **experiment**

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19 **How do we make sense of significance? Indications and reflections on**  
20 **an experiment**

21

22 **Abstract**

23 Determination of significance is widely recognised as an important step in  
24 environmental assessment (EA) processes. The prescriptive literature and guidance on  
25 significance determination is comprehensive within the field of EA, whereas descriptive  
26 and explorative studies of how we go about making sense of actions to determine  
27 significance are few.

28 This article makes use of sense-making theory to shed light on the practice of  
29 determining significance. Focus is on the first encounter with a description of a strategic  
30 choice and thus the initial judgement of significance. An experiment is designed and  
31 conducted to investigate how persons make sense of a specific strategic environmental  
32 assessment case to determine significance in a screening and scoping of the case.

33 The experiment indicates patterns in the test persons' sense-making, including important  
34 differences in the way individuals screen and scope. These patterns concern what we  
35 notice, how fast we frame the choice, and when we are critical about the provided  
36 information. The indications provide a basis for reflections on practice, hereunder how  
37 to organise EA processes.

38

39 *Keywords:* Sense-making, significance, strategic environmental assessment, screening,  
40 scoping

41

## 42 **Introduction**

43 Significance is a central concept in environmental assessments, since significance  
44 formally is the threshold that prompts assessment processes in the screening stage and  
45 the threshold for including impacts and alternatives in the scoping stage. Informally,  
46 however, assessment of significance occurs throughout the EA process and the  
47 following implementation, when decisions are made on what to include and investigate,  
48 how and at what level of detail, and finally if and how results of decisions (e.g.  
49 mitigation measures for significant impacts) are implemented in practice. Significance  
50 also plays an important role in regulations on EA, e.g. in the scope of the EU directive  
51 on strategic environmental assessment (SEA) (article 1 of the EU Directive 2001/42/EF)  
52 and in the Directive's instructions on public involvement, the content of the  
53 environmental report and monitoring. This article focuses on how people make sense  
54 and determine significance in the screening and scoping stages of SEA.

55 To guide the significance determination, the EU Directive includes significance criteria  
56 that concern the characteristics of the effects, the area to be affected as well as the plans  
57 and programmes in question. Significance is, however, not further defined in the  
58 Directive and the study concerning the report on the application and effectiveness of the  
59 SEA Directive found that “neither the Directive itself nor the SEA Guidance provides  
60 clear and unambiguous criteria for how to interpret the qualification when deciding to  
61 apply the SEA requirement” (COWI 2009, p. 50). Significance is argued to be one of  
62 the elements in the Directive, which "many lawyers and environmental assessment  
63 practitioners will be employed for many years in sorting out" (Thérivel 2004, p. 33).

64 Research has documented problems and challenges in the practice of significance  
65 determination. As an example, a study examined the results of discretion involved in  
66 screening of climate change plans, and found non-compliance with SEA legislation with  
67 lack of screening and following environmental assessment – due to the subjective  
68 judgments of practitioners (Kørnøv & Wejs 2012).

69 Despite the importance of significance in EA procedures, the concept is rarely explicitly  
70 defined in literature (Weston 2000, p. 193). Significance has been described as dynamic,  
71 contextual, political and uncertain (Wood *et al.* 2004) as increased knowledge among  
72 involved actors, change of actors, development in actors' preferences and values, and  
73 societal developments may all influence perceptions and conceptions of significance in  
74 a given context. The contextual character of significance is emphasised by Lawrence  
75 (2007b, p. 778) who points at the fact that "perceptions vary among populations and  
76 sectors of society regarding which impacts are positive and negative, and to what  
77 degree". Significance determination is therefore widely influenced by discourses and  
78 practices constituting “dynamic ‘relational complexes’ involving people, things and  
79 their many properties, competences and accomplishments” (Healy 2005, p. 239).

80

### 81 ***The Process of Determining Significance in EA***

82 EA literature provides a manifold of checklists, criteria, procedures, and thresholds to  
83 guide significance determination (e.g. Wood 2008, Lawrence 2007b, Thérivel 2004,  
84 Thompson 1990). The EU guidance is another example of a try to limit discretion while  
85 determining significance in screening and scoping (EU 2001, 2003). The literature also  
86 encounters a suggestion for inserting more “common sense” in the assessment of

87 significance (Ross *et al.* 2006) – however, without clarifying and reflecting upon  
88 differences in sense-making and thereby the non-existence of a uniform and shared  
89 common sense. Despite the manifold of thresholds and criteria, determination of  
90 significance is argued to involve "an element of judgement" (Thérivel 2004, p. 134),  
91 "subjective decisions" (Wood *et al.* 2007, p. 810), personal viewpoints (Weston 2006),  
92 value-dependency (Lawrence 2007a, p. 759) as well as intuition (Canter & Cauty 1993,  
93 p. 291). The process of determining significance has therefore been described as  
94 manipulatable (Wood *et al.* 2007) and imprecise, context-dependent, political, and  
95 complex (Lawrence 2007a). The range of adjectives seems to be an indicator for how  
96 difficult significance determination is to grasp – and the inevitability of discretionary  
97 judgment.

98 The clash between the importance of significance and the complexity of significance  
99 determination has given rise to critical questioning of the concept (e.g. Lawrence  
100 2007b), of the team determining the significance (e.g. DEAT 2002, Peterson 2010), the  
101 process of determining significance (e.g. Wood *et al.* 2004), the lack of focus (Ross *et al.*  
102 2006), and the timing and role of significance determination in practice (e.g. Nielsen *et*  
103 *al.* 2005, Christensen and Kørnø 2011). Few studies have dealt with how people in  
104 practice identify significance and very few - if any - have investigated what happens  
105 when SEA practitioners in their first encounter with a case try to make sense of  
106 information in order to determine significance in the early phases of screening and  
107 scoping. In an environmental impact assessment (EIA) context, Weston (2000) argues  
108 that "[m]ost research in EIA decision making has focused on the project authorization  
109 process and not the crucial decisions made at the earlier stages of screening and  
110 scoping" (p. 185) and Wood (2008, p. 23) points at a "paucity of research that critically

111 examines and reflects upon the way in which significance is evaluated and  
112 communicated".

113 The few studies of significance determination practice reveal elements of how we  
114 determine significance. By studying British local authorities, Wood *et al.* (2004) divide  
115 respondents into two profiles: People either demonstrated "a smooth, gradual and  
116 incremental appraisal of significance" or demonstrated a step change response  
117 "punctuated by sharp changes in relation to the size/scale of the proposal" (pp. 1 and 13).  
118 Wood *et al.* furthermore show that significance determination practice had no direct  
119 relationship with government guidance thresholds. The minor importance of official  
120 thresholds and checklist is also supported by the finding that only 2% of the local  
121 authority practitioners regarded checklists as the single most effective approach in  
122 screening practice (Wood & Becker 2005, p. 358). In a study of practitioners' balancing  
123 of precaution and efficiency in EIA scoping in the UK, Snell and Cowell find a  
124 tendency of scoping issues in rather than excluding these due to the concern of legal  
125 challenges and thereby enlarging the environmental statements (Snell & Cowell 2006).  
126 The results of a quality assessment of Environmental Impact Assessment Statements  
127 (EIS), based upon both individual and group assessment, showed significant differences  
128 with group assessments being more critical than the individual (Peterson 2010).  
129 Peterson argues that that the group approach becomes an arena for outbalancing not just  
130 expertise but also subjective values and perspectives, and suggests a revision of the  
131 current assessment practice.

132 Besides the British findings, significant determination processes in an EA context is  
133 under-researched (Snell & Cowell 2006). We still do not know the details of what  
134 happens when practitioners or researchers are presented with some kind of action and

135 asked to determine whether SEA must be applied and what impacts and alternatives are  
136 significant. Insight into similar processes can be found in other fields of study and the  
137 fields of socio-psychology and cognition seem especially relevant for shedding light on  
138 the first preliminary significance determination. Within these fields, sense-making  
139 theory has gained increased importance in the last decades with its focus on how people  
140 "construct what they construct, why, and with what effects" (Weick 1995, p. 4).

141

### 142 *Aim and Contribution*

143 The article investigates and reflects upon how to improve EA by paying more attention  
144 to the sense-making, thus emphasising the social and cognitive elements of assessment -  
145 compared to the technical and procedural. The aim of the article is to uncover how we  
146 notice and make sense of information in order to determine significance.

147 In contrast to Wood *et al.*'s (2004) retrospective investigation of significance  
148 determination, the aim is to uncover the process as it unfolds – as a direct observation of  
149 how the process evolves without retrospective filtering and reasoning. For this purpose,  
150 an experiment is designed to investigate how SEA practitioners and researchers make  
151 sense of information and determine significant impacts and SEA relevance. The  
152 experiment is aimed at the very early sense-making, at what happens the first time we  
153 see a text. This focus is chosen since research shows that the initial meaning we assign  
154 to information and events can be very influential on the following process; Gawronski  
155 *et al.* (2010) refer to a large body of research that shows that people's unconscious  
156 evaluation of events can be "relatively rigid and difficult to change" (p. 683). In an EA



157 context, this means that our initial sense-making is important for the entire process as it  
158 unconsciously may hinder openness towards new information and other actors' opinions.

159 The research questions that are guiding the article are:

160 1. *What patterns can be found in the way SEA practitioners notice cues and frame*  
161 *information in their process of making sense of a strategic choice?*

162 2. *How do such patterns influence significance determination?*

163 Since significance determination is a complex process, the investigation will not find  
164 universal patterns, but tendencies in a context. The article discusses these tendencies in  
165 terms of inspiration for improving practice.

166 The study is a part of a research project on SEA and strategic choices in the Danish  
167 energy sector (see Lyhne 2011), and the experiment is using a hypothetical but realistic  
168 case of a strategic choice in the sector.

169 In the next section, the article unfolds sense-making theory and relates it to EA. We  
170 then present the design of the experiments, before setting out the findings of the  
171 research. The article concludes with reflections and ideas on how to acknowledge the  
172 sense-making taking place at the early stages of SEA.

173

174 **Insight from literature on sense-making**

175 Karl E. Weick's theory of sense-making describes human sense-making as a social  
176 process of continuously enacting events, extracting cues from these events and  
177 retrospectively making plausible stories (Weick 1995, p. 18). Sense-making literature is  
178 focused on how people make sense of stimuli; people "sort through prior cues, label  
179 them and connect them, which often result in plausible stories that are good enough to  
180 keep going" (Weick 2001, p. 237). Mental frameworks, identity and articulation are  
181 important elements in the process of reducing multiple meanings and generate a locally  
182 plausible story (Weick *et al.* 2005, p. 414), but it is not a clear-cut process. Starbuck and  
183 Milliken (1988, p. 49) argue, "people have to have numerous sensemaking frameworks  
184 that contradict each other. These numerous frameworks create plentiful interpretive  
185 opportunities - if an initial framework fails, one can try its equally plausible converse".  
186 Frames serve the function of separating signal from noise and the filtered information,  
187 Starbuck and Milliken argue, "is less accurate but, if the filtering is effective, more  
188 understandable".

189 In a SEA context, practitioners apply mental frameworks to organise information and  
190 inputs about impacts and alternatives and enact this sense and order back into the  
191 society through reports and technical summaries.

192 Equivocal situations are accompanied by equivocality of terms. Jackson and Dutton  
193 (1986, p. 34) conclude that "simple labels do not have simple meanings". Weick  
194 emphasises the inevitable inaccuracy of terms we use to describe events: "There is  
195 always a slippage between words and what they refer to. Words approximate the  
196 territory; they never map it perfectly" (Weick 1995, p. 107). This inevitable inaccuracy

197 in labelling and understanding what we are dealing with necessitates flexibility in the  
198 SEA process to continuously reformulate and reconsider elements like the significant  
199 impacts.

200 Weick describes sense-making as a process initiated when people are experiencing  
201 discrepancies and equivocality in their on-going sensing. People first search their  
202 frameworks to explain the discrepancies. These frameworks may be "Institutional  
203 constraints, organizational premises, plans, expectations, acceptable justifications, and  
204 traditions inherited from predecessors" (Weick *et al.* 2005, p. 409). If no explanation is  
205 found, they label and notice cues in order to generate plausible stories. If these stories  
206 seem to be adequate, they are retained as guidance for future action and interpretation.

207 The process of making sense has been studied in socio-psychological research for  
208 decades. Starbuck and Milliken (1988) refer to studies that have shown that "some  
209 stimuli are more available or more likely to attract attention than others" and "the  
210 characteristics of perceivers, including their current activities, strongly affect both the  
211 availabilities of stimuli and the abilities of stimuli to attract attention". According to  
212 Watzlawick *et al.* (1974), blind spots are found in all mental frameworks and the blind  
213 spots prevent people from solving some problems. Furthermore, Bargh (1982) argues  
214 that part of our attention to stimuli is managed by automatic and involuntary processes  
215 which "can either facilitate or inhibit active attentional processing" (p. 425).

216 Learning from sense-making literature, we - as EA practitioners and researchers - need  
217 to acknowledge that we cannot fully control what we notice and what we do not notice,  
218 the words we use are never accurate, and our initial interpretation may be rigid. Sense-  
219 making literature may provide the insight that is needed to better understand and  
220 improve how we read signals of importance and frame problems and opportunities (see

221 Woodside 2000). Although the conception and the use of 'significance' differ between  
222 sense-making and SEA literature, significance plays an important role in both fields. It  
223 is thus interesting to use sense-making theory to investigate of how test persons make  
224 sense of significance in an SEA framework and reach a decision upon what aspects are  
225 relevant to include in the assessment.

226

### 227 **Methodology and Set-up of the Experiment**

228 The following presentation of the experiment aims at being reproducible, so that  
229 everyone is able to follow the steps and get comparable results.

230 To investigate patterns of noticing and framing, the experiment is constituted by a case  
231 text and a procedure for observing test persons' making sense of this text. The test  
232 persons are asked to speak out loud and underline of words and sentences while reading  
233 a text.

234 The experiment procedure is presented with reference to sense-making literature in table  
235 1. The procedure provides for access to the on-going sense-making, judgement of  
236 significance as well as occasions for test persons' reflection on the process (steps 5, 6,  
237 and 8).

238 Learning from Weick's recipe of "How can I know what I think until I hear what I say?"  
239 a confrontation of interesting statements made by the test persons is added to the  
240 experiment. The intention of this confrontation is to make the test person elaborate on  
241 interesting elements such as mental frameworks or individual sense-making processes.  
242 The number of confrontations per test person is limited to three.

243

244 Table 1. The steps in the experiment process and their relation to sense-making  
 245 literature.

Step	Task	Sense-making literature
1	A SEA practitioner [A] reads a text and during the reading underlines and comments upon what is especially interesting/useful for understanding (interruptions for clarification if needed)	Noticing and labelling of information in the enactment of the case.
2	[A] is asked to explain what she/he noticed (retell the text).  ([A] is not informed of the following stages to avoid dominance of interpretation at this stage)	Retrospective account of the noticing of cues, labelling of information and potential beginning of a story of what the case is about.
3	[A] is asked to determine possible significant environmental aspects	Creating stories of what is significant.
4	[A] is asked how she/he would go on: Is EA needed, what analyses, alternatives and measures are especially important?	Creating stories by searching for experience with relevant incidents.
5	[A] is asked of her/his idea about why she/he noticed the specific cues and whether the noticing had a personal touch	Retrospective reflection on the noticing process by the test person (steps 1 and 2)
6	[A] is asked of her/his idea about why she/he pointed at the specific significant environmental aspects	Retrospective reflection on the stories created (steps 1 and 4)
7	Before concluding, [A] re-reads text to confirm his/her understanding (with a new pen colour)	A test for a changed perceptual framework due to the thoughts in steps 4-6 and more detailed knowledge about the experiment

8	[A] is asked about potential changes in understanding caused by the second reading in step 7.	Retrospective reflection on potential changes and the reasons for these.
9	[A] is confronted with statements uttered during the experiment.	Confrontation of statements may give reactions in line with Weick's recipe of "How can I know what I think until I hear what I say?"
10	As a recapitulation [A] is asked about reflections on and learning in the experiment.	It may give indications of how the test persons think about their sense-making process

246

247

248 ***Experiment Set-up***

249 The case text has characteristics similar to the coming years of strategic energy planning  
 250 in Denmark, e.g. with its point of departure in renewable energy targets and new  
 251 technologies. The case is formulated so that test persons most likely will recognise  
 252 elements without being familiar with the situation.

253 The set-up of the experiment is:

- 254 - A number of EA/SEA researchers and practitioners are test persons ('variable' mental  
 255 frameworks). These are selected to reach a variety in the test persons' backgrounds  
 256 and occupational positions, see considerations below.
- 257 - Each test person does the experiment in isolation and the interviewers only interact  
 258 during the test persons' sense-making of the information if clarification is needed.

259 - Before the experiment starts, the aim, duration and content of the study are explained  
260 to the test persons. They are instructed to continuously speak out loud, underline  
261 words in the text, which they regard as important for understanding, and explain  
262 thoughts and underlining during the reading of the text. To enhance trust and  
263 informality, it is emphasised to the test persons that their performance will not be  
264 graded or evaluated and that there are no trick questions.

265 - The process is audio recorded, subsequently transcribed, and given to the test persons  
266 for commenting.

267 Due to resource limitations, the number of test persons for this study is set to nine. The  
268 selection of test persons has aimed at a variety in job positions, expertise in relation to  
269 the information/professional field of expertise, and educational backgrounds, see table 2  
270 below.

271

272 Table 2: Test persons in the experiment.

	Non or little familiarity with SEA	Very familiar with SEA
Very familiar with the energy case	Lotte, Anonymous, Christian	Per, Stine,
Little familiar with the energy case	Kristian	Martin, Sanne, Anja

273

274 The variety is intended to make differences in mental frameworks more explicit.  
275 Furthermore, the variety is intended to reflect that environment professionals are not the  
276 only ones who conduct SEA screening and scoping. In practice, the selection of test  
277 persons has resulted in a distribution of four university-based SEA researchers and  
278 practitioners, one consultancy-based SEA practitioner, one university-based energy

279 planner, one municipality-based energy planner, one company energy planner, and one  
280 university-based urban planner.

281

### 282 *The Case Text*

283 The case, which the test persons are presented with, is shown in figure 1. The idea  
284 behind the text is to present a strategic choice related to a societal need in a way that  
285 resemble the sparse information faced by SEA practitioners in the early stage of SEA  
286 processes. Information provided at this stage is likely to be uncertain, ambiguous and  
287 flawed when it comes to the knowledge about the consequences of the strategic choices.  
288 Therefore, the aim of the fictive case text is not to be consistent or technically correct,  
289 but potentially problematic and thought provoking. For instance, the need for storage is  
290 specified as a single, large figure without providing calculations or references. A variety  
291 in content is sought so that it involves technical descriptions, a table with numbers, as  
292 well as concrete examples of implications.

293

#### **Strategic choice of storage of renewable energy**

The high share of renewable energy (like sun, wind, and wave energy) in the future energy system makes it necessary to store large amounts of energy. 100 % renewable energy is discussed, of which windmills must constitute at least half. The periods between substantial wind speeds may last for weeks and sudden changes in weather can impact the stability of the electricity system. Therefore, the need for storage involves long-term storage and storage technologies with a short reaction time.

The need for storage has been estimated on the basis of the longest period with surplus of wind energy which amounts to 100,000 MWh. The need is, however, dependent on other initiatives within intelligent control of the electricity network, consumer behaviour, development of other storage technologies, etc.



A plan for the future energy system involves a strategic choice of storage possibilities. The Government's experts have determined that three technologies will be relevant in Denmark:

- "Compressed Air Energy Storage" (CAES) in which energy is stored as compressed air below soil layers of various depths. Turbines convert the pressure into electricity.
- "Energy islands" in which energy is stored by pumping up water into big reservoirs. The technology utilises the difference in potential energy between two water reservoirs of different heights, and energy is obtained by use of turbines.
- "Hydrogen storage" in which energy is stored by splitting water into hydrogen (and oxygen). Energy is obtained by fuel cells.

All possibilities have been tested and discussed among specialists. Different characteristics of the three technologies are specified in the table:

Storage technology	Storage period		Capacity per facility	Efficiency	Investment cost
	[Sec]	[Month]			
CAES	X	X	100-1000	75-80	Approx. 100
Energy islands	X	X	100-	80-85	Approx. 100
Hydrogen storage	X	X	10-1000	60	Approx. 500

Geographically, the technologies are different. The energy which can be stored in energy islands depends on the area and the height of the plants. Among others, a proposal has been made to close the Limfjord in one end and put up turbines for utilising height differences, or to establish wind power plants on a ring of embankment, creating a short distance between production and storage of energy. CAES and hydrogen can be established as gas storages in underground soil layers, but a proposal to use artificial air cushions just below surface has also been made. Underground storage of air and hydrogen requires only minor facilities on the surface, and there are several places in Denmark with suitable underground.

In relation to other sectors, hydrogen storage involves a dimension of being storage for hydrogen cars. The

existing natural gas network may furthermore be relevant as a transport network. In terms of research, Denmark is a frontrunner in the development of fuel cells, and the area is mentioned as a possible new wind energy adventure. The oxygen which is split from the water with the hydrogen can be utilised by the industry. The energy islands can be combined with dams and road connections, and a dam across for instance Horsens Fjord would create a large reservoir.

294 Figure 1: The case text presented to the test persons.

295

## 296 **Research Findings**

297 The findings are presented and discussed in the following subsections. Since the number  
298 of test persons is limited to nine, the findings are indicative. The most interesting  
299 indications for EA practice are:

300 1. There are substantial differences in noticing and significance determination  
301 between first and second readings of the SEA text.

302 2. Personal and professional experience can only partly explain the difference in  
303 significance determination.

304 3. Framing of the case varies depending on familiarity and practical SEA  
305 experience: The older and/or more practically experienced persons, the faster  
306 and firmer framing.

307 The following sections are structured by the two research questions outlined in section  
308 1.2.

309

### 310 ***Patterns in noticing and framing***

311 The experiment provides an empirical demonstration of the variety of how and when  
312 test persons' notice and frame the case. The most prominent findings are presented  
313 below.

314

#### 315 *Noticing and Framing is Approached Differently*

316 The experiment shows a tendency of the first reading being primarily oriented towards  
317 the factual details and examples mentioned in the text, whereas the second reading is  
318 primarily oriented towards establishing the context and a critical stance towards the text.  
319 In the first reading, the underlining thus concerns e.g. the specific technologies  
320 presented (e.g. "Compressed air energy storage") and the concrete examples of the  
321 implementation ("Closing the Limfjord in one end"). In the second reading, aspects like  
322 the strategic context (e.g. "store large amounts of energy") and the strategic alternatives  
323 ("intelligent control of electricity system") are underlined.

324 Four of the test persons show awareness of their approach to the case description. Per  
325 comments that "by the first reading I try to establish the structure and by the second I  
326 patch it up, where I have overlooked something or maybe redefine something, because  
327 you would see that some other things go on in the text". Christian explains his way of  
328 approaching the text: "Then I have some specific elements that I look for...I would not  
329 say that I memorise, but I remember the essence - maybe remembering the content more  
330 than the meaning of the text. Also because when the text is processed several times, it  
331 may be that it is another meaning that you make of the text than the first time you read it  
332 through".

333

334 *Patterns in the process of Making Sense of Aspects*

335 The experiment shows differences in how the test persons are making sense of aspects.  
336 Stine continuously puts up questions for a range of elements, which she is not familiar  
337 with, and points at a range of elements, she would have to investigate more in detail.  
338 Besides experiences and knowledge, the experiment also indicates other influential  
339 parameters:

340 • *Talking out loud triggers sense-making.* Kristian comments that his own speaking  
341 about alternatives and impacts made him notice the descriptions of initiatives and  
342 consequences in the text in the second reading. In a similar vein, Anja comments: "I  
343 am aware of it [the information], but when I have to express it, you also become  
344 more attentive to it".

345 • *Concrete examples are helpful.* Kristian especially notices the concrete examples in  
346 the text. On the closing of the Limfjord he comments: "It is a concrete proposal for a  
347 solution, which actually gives a better picture of what it is all about... If I was to  
348 remember something from this case in two weeks, it is probably that".

349 • *'Shocks' are remembered.* The closing of the Limfjord resembles a 'shock' to Lotte's  
350 mental frameworks: "Closing the Fjord! That is like "okay!" I especially notice that  
351 one, because that has indeed an environmental impact... It is absolutely absurd!"

352 • *Accessibility to numbers – compared to written text – varies.* The different types of  
353 information in the text clearly influence what the test persons notice. Especially the  
354 numbers in the table are less accessible to some of the test persons. Anja skips the  
355 table and explains: "Then there is such a typical engineer table, and then I think,  
356 "That is a bit boring and skip it". [...] I actually also skipped the table the second

357 time and I did actually not notice that I did so". The unawareness indicates the  
358 importance of the structures Anja imposed on the text in the first reading.

359 • *Local knowledge plays a role.* Identity and local relations seems to play a role in  
360 what the persons relate to. Asked about unique aspects in her noticing, Sanne points  
361 at her relation to Aalborg, close to the Limfjord: "I am, after all, a local. It is not  
362 sure that a person from Zealand [other part of Denmark] would think like that".

363

#### 364 *Experiences guide Critical Stance*

365 In the second reading, the underlining reveals, as opposed to the first reading, a critical  
366 position towards e.g. the strategic choice, the size of the need, government experts and  
367 the technologies put forward. As an example, Stine comments: "When it is this strategic  
368 level, I think it would be relevant to know the premises in terms of the projections and  
369 the expectations to the development". The difference in critical stance between first and  
370 second readings is explicitly reflected on by Martin: "What I do in the beginning is  
371 actually that I accept the premise about the future electricity system, which makes it  
372 necessary to store big amounts of energy. ... Others may say, "We need a discussion  
373 about this, before I go on"".

374 The experiment shows a tendency for critical stances to depend on the professional  
375 background, so that energy planners are critical towards the correctness of the energy  
376 problem and solutions, whereas the environmental managers are critical towards the  
377 environmental implications and the need for the energy infrastructure.

378

#### 379 *Feelings and Intuition are Influential*

380 Further, the experiment reveals some underlining and significance determination which  
381 cannot be rationally explained by the test persons. Instead, the test persons implicitly  
382 refer to 'feelings' or 'intuitions'. Martin describes his choice of what is important as a  
383 feeling of what is useful; confronted with the meaning of numbers, he argues: "it is not  
384 something that I feel in the moment that I have any use for". In such cases, noticing thus  
385 becomes a guess - a "feeling" - rather than a rational exercise. Lotte does similar non-  
386 rational underlining: "Now I underline that wind mills must constitute half of it. I do not  
387 know why I did it, but I did".

388

389 *How we frame the Case is related to who we are and what we do*

390 To explain their framing of the case text, Stine and Kristian explicitly refer to their  
391 profession; Lotte refers to the projects she is working on at the time of the experiment;  
392 Per and Anonymous relate to their experience and professional opinions. Thus, the test  
393 persons' familiarity with the energy sector and the familiarity with preparing an  
394 assessment seem to be two important dimensions of when and how significance is  
395 framed. Table 3 suggests four personal profiles of significance determination within  
396 these two dimensions.

397

398 Table 3: Profiles within the dimensions of familiarity with preparing SEA and  
399 familiarity with the energy case indicated by the experiment.

	No or low level of familiarity with SEA	High level of familiarity with SEA
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High level of familiarity with the energy case	<b>Relating</b> (Lotte, Anonymous, Christian)	<b>Settling</b> (Per, Stine)
Low level of familiarity with the energy case	<b>Seeking</b> (Kristian)	<b>Arranging</b> (Martin, Sanne, Anja)

400

401 The 'relating' profile found several associations and potentials in the energy case  
402 without a certain quick frame on what should be assessed: As an example, Lotte relates  
403 cues in the text with a number of experiences she has gained in her profession. The  
404 'seeking' profile recognised few elements in the text and did not identify a specific  
405 frame for understanding the case: As an example, Kristian explicitly stated that he  
406 emphasised the implementation examples, because they appeared 'funny' to him. The  
407 test persons familiar with similar cases and with preparing SEA were quick to settle the  
408 case in terms of what it was about and how to proceed. These persons are grouped in a  
409 'settling' profile. The 'arranging' profile found aspects to assess, but did not have the  
410 technical insight to develop a specific frame for the energy case.

411

412 ***The patterns' influence on significance determination***

413 The experiment shows that the framing of the case is not a straightforward and linear  
414 process and the influence vary over time: Noticing 'storage', Anja initially suggests that  
415 the case is about carbon capture and storage. In line with Starbuck and Milliken's "if an  
416 initial framework fails, one can try its equally plausible converse", she quickly realises  
417 its incorrectness and instead suggests an energy storage framing of the case.

418 The influence of the test persons' framing on their significance determination is  
 419 outlined in table 4. The findings indicate that test persons' framings of the text are  
 420 highly influential on their judgement of impacts, alternatives, and need for SEA.

421

422 Table 4: Test persons' dominant framings of the case and their influence on significance  
 423 determination.

Person	Framing	Influence on significance determination	Time of expression
Per	Complex systems cause conflicts and are not needed - and nature is not the problem.	No doubt about need for application of SEA. Focus on nature and land-use in terms of impacts. Focus on low-tech alternatives.	1 min.
Stine	How to get a smooth authority approval process	SEA not automatically necessary, but depending on authorities	1 min.
Christian	Societal relevance of the technologies	SEA should have been done before delimiting to three technologies	1 min.
Anonymous	Inadequate solutions to energy system planning	Critical stance on the choice. Arguing for a range of alternatives	3 min.
Sanne	Initiatives are unpopular among locals	Focus on impacts on local citizens	5 min.
Lotte	Synergies' potential	Positive potential among significant effects	7 min.
Martin	Valid determination of technologies	Initial refraining from suggesting alternatives	14 min.
Kristian	A planning task	A spatial focus in terms of significant impacts	14 min.



Anja	The big picture	(Not noticeable)	22 min.
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424

425 *When we frame the Case varies considerably*

426 As seen from table 4, some test persons develop a specific framing on what the text is  
 427 about within few minutes, whereas other test persons never seem to create an overall  
 428 framing. The two test persons with an age over 50 and a professorship were quick  
 429 (Anonymous and Per within three minutes) to assign a specific frame to the text. Also  
 430 the EA practitioners from the consultancy company and the Danish TSO quickly  
 431 assigned a specific framing to the text. Relevant experience thus seems to lead to quick  
 432 framings of the text.

433

434 *Quick Framings reduce Openness to remaining Information*

435 The energy researcher (Anonymous) comments on the text that "I immediately see what  
 436 this is all about. And then you may say that I have been trapped by my first impression".  
 437 Anonymous defends his framing: "It is obdurate, however, it is reasoned obduracy...  
 438 There is no reason to use more time on this; it is bad solutions". Anonymous and Per's  
 439 quick framings reduce irrelevant stimuli, whereby more attention can be given to the  
 440 impacts and alternatives that their framings consider as relevant. Automatic and  
 441 involuntary processes seem to work the other way around for Kristian in noticing  
 442 certain elements as funny, since they facilitate active attention to these elements.

443 The experiment findings indicate that a high level of familiarity with the energy case  
 444 may be both a pitfall and a benefit in terms of significance determination: People that  
 445 are very familiar with the energy case make a fast framing that precludes information

446 and at the same time focus their attention on what is (assumed to be) the most important  
447 elements. Similarly, a low level of familiarity may mean a more unstructured and slow  
448 process, but at the same time a critical stance on the basics of the provided information  
449 and openness towards other perspectives on the problem.

450

## 451 **Conclusion and Perspectives**

452 In this article we have proposed that sense-making is a central activity in significance  
453 determination in both screening and scoping stages of SEA. Sense-making theory  
454 provides a theoretical and methodological approach to conceptualising and investigating  
455 sense-making involved in test persons' determination of significance.

456 The experimental research has, due to the low number of test persons, no ambition of  
457 making comprehensive and general statements about sense-making in SEA processes.  
458 The research is meant as a conceptual and empirical input to the understanding of the  
459 social processes that take place initially and continually during the SEA process.

460 The experiment and findings supplement ideas and concepts within decision-making.  
461 Kørnøvn and Thissen (2000) disputed the idea that 'more information leads to better  
462 significance determination' in SEA, and the experiment shows instances where the test  
463 person developed a firm frame in the very beginning of the reading of the case  
464 regardless of the remaining information. Simon (1947) proposed the idea of 'satisficing'  
465 and the experiment shows instances in which test persons are satisficing their need for  
466 information in order to get on with the process.

467 The article furthermore underlines that the individual engaging with the SEA text is not  
468 objective and passive, but is a *sense-maker*. The text is not 'transmitted' and received

469 fully by the individual. Instead we experience the test persons as constructing stories of  
470 meaning, which involves 'negotiations' between the SEA text and the individual in the  
471 reading process and even 're-creation' of elements in the text.

472 As a consequence of the findings, sense-making is a mandate of significance  
473 determination. The question is then how we can approach our sense-making in a way  
474 that is beneficial for significance determination processes? How can we use this insight  
475 to develop a better appreciation of the link between information and significance  
476 determination? Three suggestions are provided in the following: Recognition of and  
477 reflection upon own sense-making, frame awareness in team-setting, and  
478 reconsideration of guidance and good governance.

479

#### 480 *Recognition of and Reflection on Sense-making*

481 As presented, the experiment shows a tendency of test persons being more critical  
482 during the second by questioning premises and the intention of the text. Wood and  
483 Becker (2005) propose a frame-reflective approach to counteract similar problems: "To  
484 limit the problems associated with screening errors, further guidance should seek to  
485 raise awareness of the existence of frames amongst practitioners and encourage a frame-  
486 reflective approach to screening decision making" (p. 367). They picture "frame-  
487 reflective practitioners" who actively question the basis of their assumptions and the  
488 subsequent implications, but they do further advise how it can be done in practice.

489 Insight into how we make sense like the insight the test persons gained through the  
490 experiment may be a means to be aware of assumptions. Similar to the experiment, an  
491 open dialogue with colleagues based on a comparison of what is noticed and what is

492 found significant in a given case may provide a basis for increasing our awareness of  
493 our blind spots and rigid framings.

494

#### 495 *Team-setting for Screening and Scoping*

496 The findings indicate the importance of setting a team with different profiles and  
497 different degrees of familiarity with the case. Furthermore, the findings indicate that  
498 differences in background, age and experience are needed if we want a more  
499 heterogeneous and holistic perception of the case. In this way, the findings are in line  
500 with Peterson's (2010) arguments on group-based significance determination.  
501 Awareness of the frames we employ in team-setting may thus make it possible to reduce  
502 'blind spots' and enhance a broader perspective on impacts and alternatives. Insight into  
503 frames in an organisation may therefore be important knowledge when organising SEA  
504 processes and aiming at better quality of the SEA process.

505 The different levels of sophistication of the framings identified in the experiment calls  
506 for consideration of familiarity to the case when setting the team. The higher level of  
507 sophistication plays an important role in distinguishing between significant and non-  
508 significant impacts and alternatives, and sophisticated framings may thus be a necessity  
509 to avoid that too many impacts and alternatives are scoped in rather than excluded. At  
510 the same time, less familiarity with the case may be needed to question what more firm  
511 framings take for granted. The significance determination may thus in practice benefit  
512 from openness at different levels of sophistication, so that both basic assumptions and  
513 advanced issues are critically questioned.

514 It may similarly be relevant to consider sense-making processes in the public  
515 consultation. DEAT (2002) argues that making the process of significance  
516 determination “more explicit, open to comment and public input” would be an  
517 improvement of the practice. Public consultation is an opportunity to bring a large  
518 number of mental frames into the screening and scoping process and careful  
519 consideration to the sense-making process may provide an opportunity to articulate  
520 elements that are not noticed or not labelled.

521

#### 522 *Guidance and good Governance*

523 Guidance on SEA involves a range of checklists on screening and scoping based on  
524 targets and thresholds. The limited reference of thresholds in the test persons' sense-  
525 making indicates that thresholds do not play an explicit role at this early stage. In line  
526 with the study Wood and Becker (2005) the experiment findings indicate that  
527 experience seems to play a far larger role. Thresholds and targets may rather be used as  
528 retrospective legitimacy for the choices made during meaning creation.

529 The experiment also suggests a discussion of good governance. As an example, the  
530 IAIA best practice principles state, "the [EA] process should result in full consideration  
531 of all relevant information on the affected environment, of proposed alternatives and  
532 their impacts" (IAIA 1999). The experiment findings suggest a re-consideration of such  
533 formulations, as the meaning of 'full consideration', 'all relevant information', and  
534 'affected environment' differs from person to person and from profile to profile. To  
535 acknowledge the constructionism and complexity inherent in sense-making, the best

536 practice principle could instead focus on the openness and ways of interaction during  
537 the process.

538 Overall, the perspectives point at a need to notice and recognise significance  
539 determination, have conversations in interactions about its nature and role, and make  
540 significance determination an object of both social and institutional learning.

541 The experiment is made on an individual basis, whereas sense making in practice is  
542 taking place in a social interaction between people. The individual basis is chosen to  
543 allow for an investigation of the individual's enactment and bracketing of events, which  
544 would be difficult to investigate in an experiment with social interaction; if two or more  
545 people were brought together, it would be impossible to concurrently access their  
546 thoughts as they unfold. An experiment with social interaction is a very relevant  
547 extension to the individual experiment and such an extension may reveal how the  
548 individuals' enactment and bracketing transform in a social setting.

549

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555

556

557 **References**

558 Bargh JA. 1982. Attention and Automaticity in the Processing of Self-Relevant  
559 Information. *Journal of Personality and Social Psychology*, 43, 425-436.

560 DOI:10.1037/0022-3514.43.3.425

561 Canter LW, Canty GA. 1993. Impact Significance Determination - Basic Considerations  
562 and a Sequenced Approach. *Environmental Impact Assessment Review*, 13, 275-297.

563 DOI:10.1016/0195-9255(93)90020-C

564 Christensen P, Kørnøv L. 2011. EIA Screening and Nature Protection in Denmark.

565 *Journal of Environmental Management*, 92, 1097-1103. DOI:

566 10.1016/j.jenvman.2010.11.010.

567 DEAT (Department of Environmental Affairs and Tourism). 2002. Screening  
568 (Information Series 5). DEAT, Pretoria.

569 COWI. 2009. Study concerning the report on the application and effectiveness of the  
570 SEA Directive (2001/42(EC), Final report. European Commission.

571 The European Parliament and the Council. 2001. EU Directive 2001/42/EF of the  
572 European Parliament and of the Council of 27 June 2001 on the assessment of the  
573 effects of certain plans and programmes on the environment. Bruxelles: The European  
574 Union.

575 EC. 2001. Guidance on EIA screening. European Commission.

576 EC. 2003. Commissions Guidance on the implementation of Directive 2001/42/EC on  
577 the assessment of the effects of certain plans and programmes on the environment.  
578 European Commission.

579 Gawronski B, Rydell RJ, Vervliet B, De Hourwer J. 2010. Generalization versus  
580 Contextualization in Automatic Evaluation. *Journal of Experimental Psychology:*  
581 *General*, 139, 683–701. DOI: *10.1037/a0020315*.

582 Healy S. 2005. Toward a Vocabulary for Speaking of the Engagement of Things into  
583 Discourse. *Journal of Environmental Policy & Planning*, 7, 239-256. DOI:  
584 10.1080/15239080500339745.

585 IAIA. 1999. Principles of Environmental Impact Assessment Best Practice. Retrieved  
586 from: [http://www.iaia.org/publicdocuments/special-](http://www.iaia.org/publicdocuments/special-publications/Principles%20of%20IA_web.pdf)  
587 [publications/Principles%20of%20IA\\_web.pdf](http://www.iaia.org/publicdocuments/special-publications/Principles%20of%20IA_web.pdf).

588 Jackson SE, Dutton JE. 1986. What do "Threat" and "Opportunity" Mean? A Complex  
589 Answer to a Simple Question (Ross School of Business - Working Papers Series).  
590 Retrieved [from](http://deepblue.lib.umich.edu/bitstream/2027.42/35755/2/b1408720.0001.001.pdf)  
591 <http://deepblue.lib.umich.edu/bitstream/2027.42/35755/2/b1408720.0001.001.pdf>

592 Kørnøv L, Thissen WAH. 2000. Rationality in Decision- and Policy-Making:  
593 Implications for Strategic Environmental Assessment. *Impact Assessment and Project*  
594 *Appraisal*, 18, 191–200. DOI: 10.3152/147154600781767402.

595 Kørnøv L, Wejs A. 2012. SEA screening of voluntary climate change plans: A story of  
596 non-compliant discretion. Submitted to *Environmental Impact Assessment Review*.



597 Lawrence DP. 2007a. Impact Significance Determination - Back to Basics.  
598 Environmental Impact Assessment Review, 27, 755–769. DOI  
599 10.1016/j.eiar.2007.02.011.

600 Lawrence DP. 2007b. Impact Significance Determination - Pushing the Boundaries.  
601 Environmental Impact Assessment Review, 27, 770–788. DOI:  
602 10.1016/j.eiar.2007.02.010.

603 Lyhne I. 2011. Between Policy-Making and Planning: SEA and Strategic Decision-  
604 Making in the Danish Energy Sector. Journal of Environmental Assessment Policy and  
605 Management. 13, 1–23. Doi: 10.1142/S1464333211003912.

606 Nielsen EH, Christensen P, Kørnø L. 2005. EIA Screening in Denmark: A New  
607 Regulatory Instrument? Journal of Environmental Assessment Policy and Management,  
608 7, 1-15. DOI: 10.1142/S146433320500192X.

609 Peterson K. 2010. Quality of environmental impact statements and variability of  
610 scrutiny by reviewers. Environmental Impact Assessment Review, 30, 169-176. DOI:  
611 10.1016/j.eiar.2009.08.009.

612 Ross WA, Morrison-Saunders A, Marshall R, Sánchez LE, Weston J, Au E, Morgan,  
613 RK, Fuggle R, Sadler B. 2006. Round Table: Common Sense in Environmental Impact  
614 Assessment: It is not as Common as it should be. Impact Assessment and Project  
615 Appraisal, 24, 3-22. DOI: 10.3152/147154606781765354.

616 Simon HA. 1947. Administrative behavior. A study of decision-making processes in  
617 administrative organizations. New York: The Macmillan Company.

618 Snell T, Cowell R. 2006. Scoping in Environmental Impact Assessment: Balancing  
619 Precaution and Efficiency? *Environmental Impact Assessment Review*, 26, 359-376.  
620 DOI: 10.1016/j.eiar.2005.06.003.

621 Starbuck WH, Milliken FJ. 1988. Executives Perceptual Filters: What They Notice and  
622 how They Make Sense. In D. Hambrick (Ed.), *The Executive Effect: Concepts and*  
623 *Methods for Studying Top Managers* (35-65). Greenwich: JAI Press.

624 Thérivel R. 2004. *Strategic Environmental Assessment in Action*. Earthscan: London.

625 Thompson MA. 1990. Determining Impact Significance in EIA: A Review of 24  
626 Methodologies. *Journal of Environmental Management*, 30, 235-250. DOI:  
627 10.1016/0301-4797(90)90004-G.

628 Watzlawick P, Weakland J, Fisch R. 1974. *Change: Principles of Problem Formation*  
629 *and Problem Resolution*. New York: Norton.

630 Weick KE. 1995. *Sense-making in Organizations*. London: Sage.

631 Weick KE. 2001. *Making Sense of the Organization*. Oxford, UK: Blackwell Publishing.

632 Weick KE, Sutcliffe KM, Obstfeld D. 2005. Organizing and the Process of Sense-  
633 making. *Organizational Science*, 16, 409–421. DOI: 10.1287/orsc.1050.0133.

634 Weston J. 2000. EIA, Decision-Making Theory and Screening and Scoping in UK  
635 Practice. *Journal of Environmental Planning and Management*, 3, 185–203. DOI:  
636 10.1080/09640560010667.

637 Weston J. 2006. Common sense in environmental impact assessment -- it cannot be  
638 avoided. *Impact Assessment & Project Appraisal* (Beech Tree Publishing), 24(1), 12-14.

639 Wood G. 2008. Thresholds and Criteria for Evaluating and Communicating Impact  
640 Significance in Environmental Statements: ‘See no evil, hear no evil, speak no evil’?  
641 Environmental Impact Assessment Review, 28, 22–38. DOI: 10.1016/j.eiar.2007.03.003.

642 Wood G, Becker J. 2005. Discretionary Judgement in Local Planning Authority  
643 Decision Making: Screening Development Proposals for Environmental Impact  
644 Assessment. Journal of Environmental Planning and Management, 48, 349-371. DOI:  
645 10.1080/09640560500067467.

646 Wood G, Glasson J, Rodriguez-Bachiller A, Weston J. 2004. Evaluating Significant  
647 Environmental Effects: Fuzzy Sets and Decision Making in EIA (Award R000239676).  
648 Retrieved from Oxford Brookes University website: [http://www.esrc.ac.uk/my-](http://www.esrc.ac.uk/my-esrc/grants/R000239676/outputs/Read/3c18b140-3ae9-49f1-b616-433602112c14)  
649 [esrc/grants/R000239676/outputs/Read/3c18b140-3ae9-49f1-b616-433602112c14](http://www.esrc.ac.uk/my-esrc/grants/R000239676/outputs/Read/3c18b140-3ae9-49f1-b616-433602112c14).

650 Wood G, Rodriguez-Bachiller A, Becker J. 2007. Fuzzy Sets and Simulated  
651 Environmental Change: Evaluating and Communicating Impact Significance in  
652 Environmental Impact Assessment. Environment and Planning A, 39, 810-829. DOI:  
653 10.1068/a3878.

654 Woodside AG. 2000. Introduction. In: A.G. Woodside (Ed.) Getting Better at  
655 Sensemaking (xi-xix). Retrieved from <http://www.emeraldinsight.com/>.