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PROCESSING NEGATION IN THE CONTEXT
OF ADJECTIVAL ANTONYMY

In a series of experimental studies we deal with processing negation in adjectives, with recognition of their affective value. For the studied material we chose adjectives describing people in categories of positive and negative characters. We used linguistic and extralinguistic negation (known also as external negation) to study the difficulty (measured in time of categorizing and number of mistakes) in processing negated adjectives which belonged to three groups, distinguished on the function of the morpheme "no". The main effect of negation type, as well as interaction of the negation factor and the affective sign of the adjectives, occurred in every group. The type of applied negation determined which adjectives, positive or negative, were categorized faster and more appropriately. The study showed close interaction between cognitive and affective processing.

Key words: negation, adjectival antonyms, affective adjectives, negativity effects

There is no doubt that negation is important in our everyday language and communication process. It is connected with refusal *(I won't do that.)* and issuing bans *(No parking.).* Directives (i.e. orders, suggestions, requests, persuasions) may take a negative form *(Do not be nervous. Do not forget.).* We often use negations to correct somebody's utterance, when we think that somebody is wrong or says an untruth *(You are wrong, it did not happen then).* Negation may appear in the description of events or actions especially when we want to say that something did not happen or was not done *(John did not come to work today).*

This paper concerns negation in representatives (Searle, 1970), i.e., in utterances in which the speaker expresses his or her opinion about the authenticity of a state of affairs. Negation in representatives has two forms (according to the distinction in logic): as sentence negation (*X is not Y*) and as name negation (*X is not Y*).

The subject of this paper is how the way of processing negation is communicate in people's descriptions. Describing and estimating somebody (something) in

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categories of character or disposition may be a sentence negation of the type *X is not Y* (e.g. *John is not moral. Paul is not rich,* etc) or name negation, i.e. by means of negated adjectives. You can say about somebody that he is *immoral* (*innocent, unkind, unfailing, etc*). This type of negation is the subject of the present experiments. Here we notice that, in the Polish language, negated adjectives are either at the pole of antonymy (*immoral* is an antonym of *moral*) or takes an intermediate position on the axis of gradation of the character (e.g. *not bad* is somewhere between *good* or *bad*).

Why we describe people by means of negatives and how we process these descriptions

The most common problem connected with negation is the influence of negation on comprehension and on assessment of the truth of sentences. Previous experiments carried out in the 60s and 70s used sentence verification tasks where the sentence was verified either against general knowledge (Wales & Grieve, 1969; Wason & Jones, 1963; Wason, 1965) or against the picture presented before or after the given sentence (Carpenter & Just, 1975; Clark & Chase, 1972; Trabasso, Rollins, & Shaughnessy, 1971; Gough, 1966). More indirect experiments were also carried out. These included testing the conclusions that were drawn of negative sentences in comparison with those drawn of affirmative sentences (e.g. Just & Clark, 1973). The other experiments consisted in checking compliance with negative instructions (Jones, 1968). In all these experiments, negative sentences were more difficult to process than affirmative sentences – the evidence being longer response times and/or higher levels of errors for negative sentences as compared to affirmative sentences.

However, when experiments included the variable of logical value of the sentence (true-false), in some experiments there was the main effect of true value gained (true sentences were processed faster than false ones), while in other experiments there was an interaction of negation and logical value (Carpenter & Just, 1975) – in the case of affirmatives true sentences are easier to evaluate than false ones, but in the case of negatives true sentences are more difficult to process than false ones. These results can be explained by the fact that participants use two different strategies in processing negative sentences. In one strategy, they change negative sentences into affirmative ones while maintaining the same logical value conditions (so-called *fusion* model) – this strategy allows for us to explain the main effect of logical value. The other strategy (so-called *schema-plus-tag* model) consists in using the core of the negative sentence for comparison (matching the stem and a picture occurs with false sentences), thus there is an interaction of negation and logical value.

These two models of processing sentence negation concern also sentences that do not need logical value evaluation. In recent experiments (see Mayo, Schul & Burnstein, 2004; Maciuszek, 2006), it was shown that the way sentence negation concerning people's descriptions is processed depends on the kind of predicates

included in the scope of negation. Negations including complementary terms are processed according to the *fusion* model and negations concerning uni-polar descriptions by the *schema-plus-tag* model. But encoding negation according to the latter model means that some negated matters are activated, according to the *fusion* model: the negation operator suppresses activation of the included ideas. The other explanation of processing negation is included in the present Two-Step Simulation Hypothesis of Negation which assumes that negation is represented in experiential simulations (Kaup, Zwaan & Lüdtke, in press).

Regardless of the difference in ways of explaining negation processing experimenters agree that negative sentences are more complex in a cognitive sense. There is greater difficulty in processing them and they generate more communication errors. Nevertheless, negatives are quite often used in everyday communication, e.g., in people's descriptions. The reason for using them is sometimes to correct somebody's utterance; representatives in the negative form are uttered when the speaker is sure that the comprehender's information is false. Wason (1965) emphasized that negatives are used when the usual course of events changes, when something happens that is inconsistent with opinions and expectations of the comprehender. Colston (1999) appeals to semantic questions to explain why people use relatively complex negated forms in expression instead of simple direct forms, and shows the asymmetry of the direct term meaning and their negated opposites. In his words, interlocutors' expectations in situations where the utterance concern is of great importance in negation interpretation; if you expect that events will be positive, there is an asymmetry of meaning; a directly negative term (e.g. in the utterance *His behavior was wrong*) has the same meaning as a negated positive term (e.g. *His behavior was not good*) but directly positive terms do not have the same meaning as negated negative terms. However, when you expect that events are going to be negative, this asymmetry disappears; directly positive (or negative) terms have the same meaning as their negated opposites (see Colston, 1999, experiment 1 & 2). He explains these findings by referring to the theory of relevance and verbal politeness.

Asymmetry mainly concerns name negation and processing antonymy. As noted earlier, negation in people's descriptions takes the form of name negation consisting in negated adjective use. (To be acquainted with how they are processed is not only of theoretical value but also in conclusions about communication). To pave the way for formulating the problem and designing the experiments (which will concern processing negation including adjectives and taking account of their valence) we need necessary psycholinguistic analyses about antonymy and markedness.

Asymmetry in antonym processing

Antonyms are regarded as one of the most important semantic relations. They are lexical units in a conceptual field characterized by opposition of meaning. Opposition means that negation of the meaning of one unit leads indirectly or directly

to that of the other unit (Cruse & Togia, 1995). What is the relation of antonyms to contradiction and negation? Okuniewska (2004) points out that the difference in a pair of antonymous adjectives is the presence of negation in one of them: linguistic or logical. Linguistic negation lies in the word structure as the *in* prefix (*immoral* vs. *moral*), but in the case of logical negation (inherent) the negation is hidden, i.e. invisible in the morphological structure of the word (*bad* is in opposition to *good, short* to *tall, empty* to *full*). Both kinds of negation may appear in one word (e.g. *nonempty*). Antonymy is constructed on the basis of logical or linguistic negation; if elements of the opposition have different stems we can speak of lexical antonymy (two-stem) and if one element of antonymy is a negated adjective we can speak of grammatical antonymy (one-stem).

Markedness and negation

The linguistic theory of semantic markedness is linked to the question of asymmetry within pairs of antonymous adjectives. Markedness concerns the relation between lexical units that are opposite to each other. This relation consists in the fact that the poles of the opposition differ in complexity. One of them contains an element that does not occur in the structure of the other one. The most frequent linguistic or logical negation is found in that additional element.

Antonymic asymmetry appears in children's language acquisition and processing (comprehending) of sentences; non-marked ones are acquired earlier in language development and are processed and recollected faster than marked ones. In the case of lexical antonymy asymmetry manifests itself in the tendency to avoid negated adjectives in descriptions of neutral objects (regardless of the negative or positive meaning of those words).

An explanation of this cognitive asymmetry lies in reference to cognitive complexity. According to Clark (1977), the negation element (creating markedness) in its explicit, grammatical (*not, in-*), as well as in its hidden, semantic form, increases the cognitive complexity of the word and the greater difficulty in marked word processing as compared to non-marked. In a series of experiments, Clark (1974) compared processing these two negation cases. In one experiment, the participants assessed the truth or falsity of sentences relating to pictures. These sentences differed on the presence of marked and non-marked words and form: affirmative or negated. First, affirmative sentences were used with non-marked words (e.g. *The square is present*). Second, affirmative sentences were used with marked words (e.g. *The circle is absent*), third, negative sentences with non-marked words (e.g. *The square is not present*). And finally, negatives with marked words (e.g. *The circle is not absent.*). An indicator of phrase complexity was the processing time of sentence truth. Affirmative sentences with a non-marked adjective were processed the fastest (e.g. *present*), then affirmative sentences with a marked adjective, i.e. inherent negation (e.g. *absent*) and the longest processing time was for sentences

containing grammatical negation (e.g. *not present*). According to Clark, differences in processing time (i.e. greater latency for grammatical negation than for inherent) are connected with a difference in two negation procedures: one of them concerns a single word and the other a syntactic negation, i.e., it concerns combining words into bigger constructs and it is more difficult to process.

And, according to Osgood (1980), the greater difficulty of processing adjectives is connected not with cognitive complexity but with affective negativity (it is more difficult to process affectively negative adjectives). Osgood and Hoosain (1983) designed an experiment consisting in measuring the time and accuracy of recognizing the basic and negated adjective valence. Positive and negative adjectives appeared on the screen and participants were to react by pressing a "yes" or "no" button on the experimenter's evaluation: "positive" or "negative". The results confirmed the assumption of their theory; negated adjectives with positive valence (e.g. *unbiased*) were recognized faster than basic adjectives negatively valenced (e.g. *biased*).

These two attitudes are not mutually exclusive if we assume a high correlation of grammatical negation and an inherent one with negativity. Negated adjectives more frequently have negative than positive meaning because negative prefixes are easier to combine with positive words – linguists call this phenomenon the greater productivity of positive than of negative words. In many languages (including Polish), negated adjectives with positive emotional value appear much more rarely. This was demonstrated by Mann's (1967) experiments which show that we use negatives to describe negative characters more often than to describe positive ones.

However, markedness in adjectival antonymy does not always connect with negative valence. According to Okuniewska (2004), negation and, what follows, markedness are independent of word valence. In her experiments, she checked differences in evaluative antonymous adjective choice to describe hypothetical people. Her results show the individual character of markedness variables and of evaluation variables, and the hierarchical character of the asymmetry phenomenon in language utterances. Participants prefer semantically simpler words (devoid of logical and linguistic negation) irrespective of their valence. Semantic complexity affected the choices more than morphological complexity; i.e., participants avoided inherent negation more than linguistic negation. Those findings combine the assumptions of Clark's markedness theory and Osgood's valence theory, showing a variable hierarchy that reveals the primacy of explanations in the cognitive complexity category over explanations in the cognitive-affective category (Okuniewska, ibidem, 97).

In Zagrodzki's experiment (1986), a negation processing task was connected with testing the semantic complexity of dimensional antonymous adjectives (e.g. *long – short*) and their negatives (e.g. *not long – not short*). The author assumed a longer assessing time if a presented object has a character named by a given kind of adjective, due to the greater semantic complexity of adjectives. Adjectives used in the experiment related to simple physical dimensions which enabled experimenters to minimize their valence. The following kinds of adjectives were distinguished:

non-marked antonymy part (e.g. *long*), its antonym (*short*) and negation of both antonymy parts (*not long* and *not short*). If we agree with the author's assumption that reaction time is evidence of semantic complexity, his experiment showed that the semantically simpler word is an adjective without negation, i.e. the non-marked part of the given antonymy (e.g. *long*). A more semantically complex word is its direct antonym, i.e. a word containing a logical negation (e.g. *short*). Much more complex is a word containing a linguistic negation (e.g. *not long*), and the most complex is a word containing bath linguistic and logical negation (e.g. *not short*). Thus, other than in Okuniewska's experiments described above, an advantage of morphologically non-marked words over semantically non-marked words appeared. But those two experiments differed in a few important respects: time pressure (in Zagrodzki's experiment), use of an affective variable (in Okuniewska's experiment), and a different kind of task (choosing an adjective to describe a person *vs.* assessing if a description is true in relation to a picture).

The experiments of Clark, Osgood, Okuniewska, and Zagrodzki concerned different aspects of processing adjectival antonym negation. Osgood was interested in recognizing adjective valence without negation conditions and in linguistic negation conditions. Okuniewska used valenced adjectives – differentiated for presence or absence of logical and linguistic negation – testing the hierarchy of those adjective choices to describe neutral objects. Zagrodzki, omitting antonymous adjective valence and their linguistic negations, asked about their semantic complexity measured by physical characters of a picture assessing time. His experimental paradigm was the closest to Clark's approach who additionally compared processing logical negation (inherent) and sentence negation.

In my experimental project I decided to develop the above experimental paradigms introducing different levels of three factors: negation conditions, kind of adjectives distinguished by the *not* function, and adjective valence. I was interested in processing the negation of adjectives used in people's descriptions in categories of positive and negative characters. The basic negation mark is *not* and *in-* (as in the sentence *John is not wise. / John is not stupid.*). However, negatives are signalized also by non-linguistic marks and are not part of the communication itself. For example, a comprehender on the basis of his or her knowledge about the speaker may conclude that the communication is false. So the change of the communication meaning to its opposite may result not only from the linguistic mark like *not* or *in-* but also from situation signals, like credibility of a speaker or non-verbal signals (e.g. facial expression, tone). In the experiments described below, red color signalized that a communication has an opposite meaning (see Gilbert, Tafarodi & Malone, 1993) and this negation condition is called external. It cannot be decided *a priori* if the effects of processing these negation conditions will be similar, which that is why comparing linguistic and external negation seems to be so interesting. Double negation, which is a combination of linguistic and external negation, was also used.

Experiment 1

The subject of the experiments was processing negation connected with recognizing the valence of words describing people. As Lyons (1984) emphasizes, in the case of antonymous adjectives there is a division into the semantically positive part and the semantically negative part; antonymy poles often have simply positive or negative emotional value. In the present experiments we use antonyms whose emotional – positive or negative – meaning is easy to define (e.g. *good, bad, wise, stupid*).

The problem in experiment 1 concerns processing negatives using valenced adjectives (positive and negative) with different kinds of negation (linguistic negation, external negation, double negation). The participants were to classify adjectives appearing on the computer screen in POSITIVE or NEGATIVE categories, and response time and mistakes made were measured. Adjectives were chosen describing physical and psychological characteristics of people that are unambiguously valenced.

There were four conditions connected with negation:

First, lack of negation, i.e., using basic adjectives (e.g. *wise*);

Second, linguistic negation, i.e. adjectives negated with the prefix *in-* (e.g. *immoral*);

Third, the procedure was used of a font color to convey the information that the adjective appearing in red has the opposite meaning (thus, the word *wise* written in red should be classified as NEGATIVE). This case was called external negation. Here, instead of the prefix *in-*, as the most frequent mark of negation (Kreuz & S'dek, 2001), an extra-linguistic mark was used. The aim was to compare the effects of linguistic and external negation and to compare processing basic adjectives and processing the same adjectives with external negation;

And fourth, double negation was used where the red font color marked a negative adjective. The measured variables were adjectives classifying time and precision measured by the number of classifying mistakes.

Taking into consideration the different functions of *not* and *in-* (*nie*), there were three groups of adjectives (as a between-subject factor): Group no.1 – adjectives whose negatives are the antonymy pole (*moral – immoral*), Group no. 2 – adjectives that are lexical antonymy poles (*pretty – ugly, good – bad*), for which *not (nie)* has a gradual function: a negated adjective has an intermediate position between two antonyms (e.g. *not ugly*), Group no. 3 – uni-polar adjectives whose negation is non-lexical. Uni-polar adjectives are those that do not have easily accessible equivalents of opposite meaning and do not appear with *not* or *in-*, so generally they are not a pole of lexical or one-stem antonymy (e.g. *cynical, charismatic*). They were separated out on the basis of preliminary experiments where the participants were presented with a list of adjectives and were to name the first opposite word that came to mind. Uni-polar adjectives were those for which it was difficult to

find opposites (when at least 80% of the participants did not name the same word as the opposite).

The choice of adjective kind for the experiments as a between-subject factor was also an attempt to avoid the situation where the category of marked adjective coincide with the category of adjective negatively valenced. This situation happens in Group no. 2 where there are two antonymy poles and the negatively valenced part is the marked part. Thus, it is more difficult to assess if a possible difference in rate and correctness results from the valence of the adjectives or from the additional element in the semantic structure of one of the opposition poles that is logical negation. In the other groups we avoid this kind of situation; in the case of one-stem antonyms (Group no. 1) in the lack of negation conditions there are non-negated antonymy poles, so that positive as well as negative adjectives are not marked (their negated poles are marked). In Group no. 3 (uni-polar adjectives), the question of markedness is not important because markedness concerns opposite lexical units.

Method

Participants and Design

Eighty-one 19–25 year old students (69 women and 12 men) of the Applied Psychology Institute of Jagiellonian University took part in the experiment. They were placed in three experimental groups. There were 26 people in Group no.1 (two men), in Group no.2 27 people (four men) and in Group no.3 28 people (six men). Participation in the experiment was voluntary and participants did not receive any remuneration. The experiment consisted of 3 (Kinds of Adjectives: adjectives with antonymous *in- (nie) vs.* adjectives with gradual *not (nie) vs.* uni-polar adjectives) x 4 (Negation Kind: affirmative *vs.* linguistic negation *vs.* external negation *vs.* double negation) x 2 (Word Valence: positive *vs.* negative).

Materials and Procedure

The experimental task consisted in classifying stimuli words in categories appearing on the screen. In this experiment the basic categories are POSITIVE and NEGATIVE appearing at the top of the computer screen to the left, and to the right to which the participants should have responded, by pressing right and left *Shift* key, adjectives appearing in the middle of the screen one by one. Classified words were adjectives in a few series in the following versions: 1. basic adjectives (non-negated) e.g. *moral*, 2. negated adjectives e.g. *immoral,* 3. externally negated adjectives e.g. *moral* written in red font color, 4. double negated adjectives i.e. negated adjectives written in red font color.

The scheme of experiment 1 series:
- Training series: classifying positive and negative nouns
- I. Basic adjectives without negation

- – 1 series – basic categories in setting: NEGATIVE / POSITIVE
- – 2 series – basic categories in setting: POSITIVE / NEGATIVE
- ‣ II. Linguistic negation: series 1 and 2 of adjectives negated with *not, in-*
  - – 3 series – basic categories in setting: NEGATIVE / POSITIVE
  - – 4 series – basic categories in setting: POSITIVE / NEGATIVE
- ‣ III. External negation: basic adjectives in red font color
  - – 5 series – basic categories in setting: NEGATIVE / POSITIVE
  - – 6 series – basic categories in setting: POSITIVE / NEGATIVE
- ‣ IV. Double negation: negated adjectives negated externally (in red font color)
  - – 7 series – basic categories in setting: NEGATIVE / POSITIVE
  - – 8 series – basic categories in setting: POSITIVE / NEGATIVE

In each series 18 stimuli words randomly appeared, 9 positive and 9 negative, preceded by two training words whose classifying time was not included in the results. The above scheme was identical for the three kinds of adjectives which were the inter-group factor. When choosing adjectives for the classifying task experimenters selected popular words, i.e. of high frequency and unambiguous valence (positive - negative).

Basic experimental problems and expectations

Of special interest were the following questions: Dodifferences in classifying difficulties depend on negation operations (no negation, linguistic negation, external negation, double negation). In particular, what is the relation between processing linguistic negation and processing external negation? Is there a difference between processing positive adjectives and negative ones? Is a possible difference related to the kind of negation used? Does processing negation change depending on the kind of adjective (distinguished on *not* function) and does their kind affect recognizing their valence?

It was predicted that basic adjectives (not negated) would be processed faster and more correctly than negated adjectives (linguistic negation, external negation, double negation). This prediction is based on the tradition of processing negation experiments which confirms that the presence of negation makes communicative cognitive complexity greater (McDonald & Just, 1989). It was more difficult to predict comparison results of processing linguistic negation and external negation. With linguistic negation we encounter cognitively complex words (markedness) while external negation demands negating the word in question. It seems that the kind of adjective is important; in Group no.3 (uni-polar adjectives) external negation should be a simpler operation than linguistic negation that demands processing a complex word with the prefix *in-,* which is not common in everyday communication. Comparing linguistic negation and external negation in the other groups will let us assess to what degree negated adjectives (popular in everyday communication) are encoded as independent words having their own semantics and to what degree they

are encoded as derivative of a basic adjective (if, for example, the word *immoral* is an independent semantic unit, it should be classified faster than the word *moral* negated by the font color). It can be predicted that associated linguistic negation and external negation (so called double negation) will make classifying more difficult by delaying reaction time and will increase the number of mistakes.

Another group of predictions is connected with the question of word valence in different negation conditions. In the case of a basic (not negated) adjective classifying task you should expect (e.g. according to Osgood's idea) that the positive adjective classifying task (e.g. *wise*) would be easier, i.e., faster and with fewer mistakes, than the negative adjective classifying task (e.g. *stupid*) in all the groups of adjectives. Concerning Group no.2 (lexical antonyms) this supposition results also from the markedness idea; positive adjectives are not marked so they should be processed more easily than negative adjectives. And, in the case of linguistically negated adjectives one can assume (in opposition to Osgood's idea) that negative adjective processing would be easier than processing positive ones; i.e. classifying time of the former ones will be shorter and with fewer mistakes. This assumption is based on a few premises, the first two of which concern lexical antonymy (Group no. 2). First, on the basis of the markedness idea and Zagrodzki's experiment results (1986) one can predict that in Group no. 2 negated adjectives negatively valenced as less semantically complex will be processed more easily than negative adjectives valued positively (the former contain linguistic negation while the latter contain linguistic as well as logical negation). Second, semantic analysis shows that a non-marked word negated with *in-* is semantically closer to a marked word than a negated marked word to a non-marked word; *not good* is semantically closer to *bad* than *not bad* to *good* (Okuniewska, 2004). If we assume that basic positive adjectives are more often not marked, their negatives being closer to the negative pole are easier to be classified NEGATIVE than negated positive adjectives that are further from the positive pole. Third, negated adjectives, in lexical antonymy as well as grammatical, more often appear as negative than positive (negative prefixes combine with positive words more easily – the so-called greater productivity of positive words over negative ones) – hence we are accustomed to negated adjectives as negatively valenced. Fourth, *not* is associated with something negative: refusal, falsehood, disagreement; so an adjective beginning with *not* or *in-* activates negative meaning more easily than positive meaning. Predictions connected with external negation should be based on different premises, because a negation mark – instead of *not* – is an extrasemantic mark. Faster processing of basic positively valenced adjectives should result in faster negating operations and faster changing of their valence than in the case of basic adjectives negatively valenced. Differences can be predicted in managing the classifying task depending on the kind of adjective group. In the case of linguistic negation the more difficult classifying task should be connected with uni-polar adjectives (Group no.3) because their negation is – as mentioned above – non-lexical.

Results

Adjectives classifying time

Incorrect responses (5.3%) and two responses that were first in each block were excluded from analyses. A 3 (Kind of Adjectives) x 4 (Negation Conditions) x 2 (Word Valence) ANOVA revealed a significant three-way interaction, $F(6, 234) = 10.69$; $p < 0.001$, $\eta^2 = 0.21$. Additionally, the main effect of the negation condition appeared ($F(3, 234) = 105.89$; $p < 0.001$, $\eta^2 = 0.57$) and the main effect of adjective valence ($F(1, 78) = 11.11$; $p < 0.01$, $\eta^2 = 0.12$). Also, the negation condition and kind of adjective revealed a significant interaction, ($F(6, 234) = 4.48$; $p < 0.001$, $\eta^2 = 0.10$). The negation condition and word valence revealed a significant interaction ($F(3, 234) = 38.24$; $p < 0.001$, $\eta^2 = 0.32$).

It turned out that the two main effects, and almost every interaction (except valence and kind of adjective), were statistically significant. This means that classifying time significantly depends on negation conditions, and adjective valence influences classifying time. The most interesting factor is that the kind of negation interacts with the kind of adjective as well as with classified word valence. This means that the influence of four negation conditions on classifying time differs depending on classified adjective valence and adjective kind. The interaction of two independent variables changes also depending on the level of the third independent variable (there was registered a three-factor interaction, which means that the interaction of the kind of negation and adjective valence changes depending on the kind of adjective). Interesting also is the lack of an interaction effect of the kind of adjective and their valence; this shows that differences in adjective processing time depending on valence is similar for every distinguished kind of adjective.
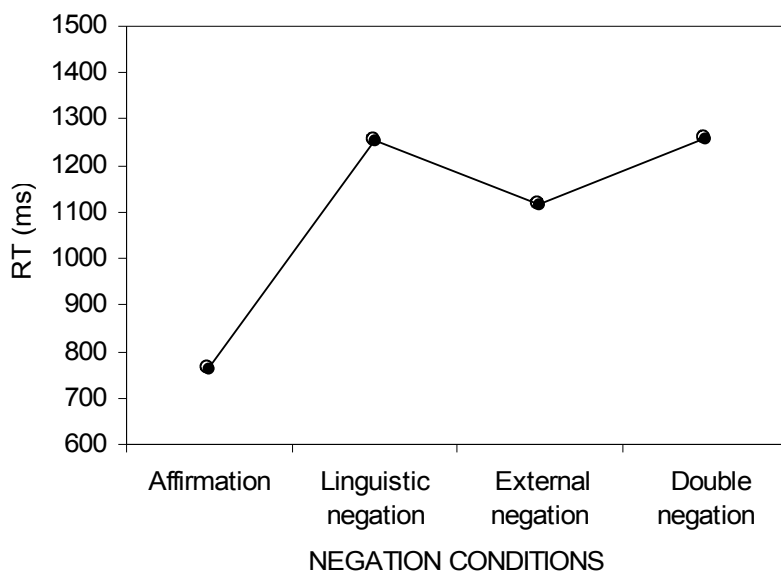
Results will be presented in the following order: I will start from the main effect of the conditions of negation, then present the factor connected with adjective valence, and then investigate the character of these two factors' interaction. Finally, I will investigate the role of the kind of negation and adjective valence in particular adjective groups.

The kind of negation and adjective valence vs. classifying time

First, attention is drawn to the main effect connected with negation conditions (no negation, linguistic negation, external negation and double negation).

It appears that adjective classifying time (regardless of their valence and the distinguished groups) depends directly on negation conditions. Definitely fastest were classified basic adjectives, i.e. those that were not negated (average 765 ms). This is understandable because of the least cognitive complexity of this kind of stimuli. Classifying with linguistic negation (average 1256 ms) took more time than with external negation (average 1115 ms); $t(81) = 5.6$; $p < 0.001$. It is interesting that classifying time with double negation (average 1259 ms) was almost identi-

Figure 1. Classifying time – main effect of negation conditions (Experiment 1)
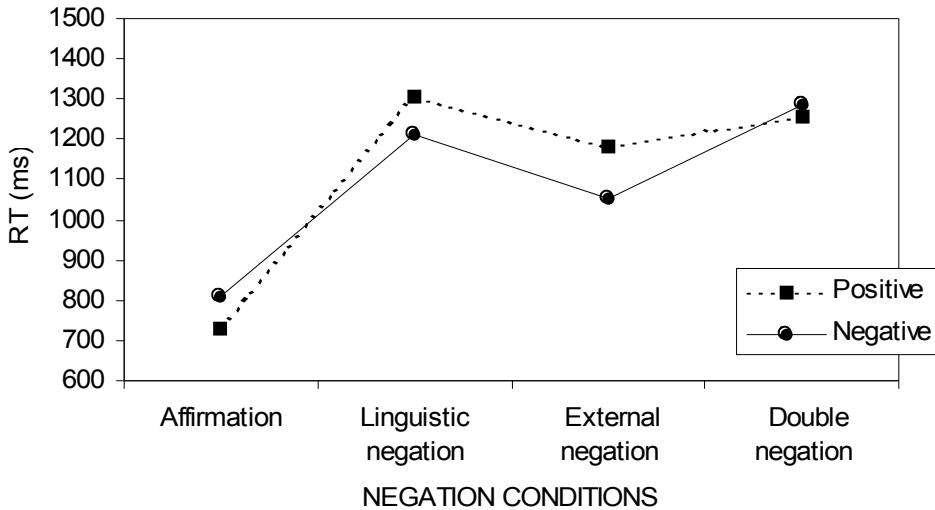

cal with classifying time with linguistic negation, which makes it improbable that those two kinds of negation proceeded sequentially, i.e. external negation was used after processing linguistically negated. These trials would lead to the increase in complexity of processing double negations in relation to linguistic negations. However, that did not happen. This means that participants did not follow two negation procedures (linguistic negation and external negation) but probably discovered the simpler strategy of processing double negation, i.e. ignoring (neutralizing) both the negation marks. The premise for this conclusion may be analysis below presented of the interaction of two variables: kind of negation and adjective valence.

What is the relation between negation conditions and adjective valence? The interaction effect shows that the impact of one of these independent variables is different on different levels of the other independent variable. This interaction is illustrated by the chart below (Fig. 2).

In the case of basic adjective processing (no negation), positive adjectives are classified significantly faster (average 727 ms) than negative adjectives (average 808 ms); $t(81) = 6.57$; $p < 0.001$. Thus, on the level of basic adjectives, Osgood's thesis was supported. He assumed more difficult processing of negative adjectives. However, he claimed this to be independent of their cognitive complexity. The interaction chart above shows that this thesis (at least on the ground of the Polish language) is falsified. The greater cognitive complexity of negated adjectives positively valenced makes their processing longer than processing non-negated adjectives negatively valenced. On the level of linguistic negation, the relation changes between the clas-

Figure 2. Classifying time – interaction of negation condition and adjective valence (Experiment 1)

sifying time of positive and negative words: adjectives negated by *not* or *in-* with negative valence are classified into the NEGATIVE category (average 1212 ms) faster than the positive into POSITIVE category (average 1304 ms), t(81) = 5.14; *p* < 0.001. Also in the case of external negation, classifying into the NEGATIVE category (average 1052 ms) was faster than classifying into the POSITIVE category (average 1184 ms), and the difference between them was greater than in the case of linguistic negation.

An interesting change of tendency is observed in the case of double negation: in this case there are no clear differences between the levels of an analyzed variable, t(81) = 1.54; *p* = 0.126, but classifying words into the POSITIVE category (average 1254 ms) is a little bit faster than into the other category (average 1285 ms). This pattern of results demonstrates the above mentioned supposition that the participants coped with the potentially very complicated task of processing double negation using the strategy of ignoring both kinds of negation. Probably this is why the relation between classifying positive and negative words started to resemble the case of basic adjectives.

Thus, we observe a simple effect of adjective valence in the case of three out of four negation conditions. Recall that the three-way ANOVA shows also that the interaction of the two factors mentioned above changes depending on the level of the third factor, i.e. the kind of adjective distinguished because of *not* or *in-* function. That is why we need to pay attention to the specific character of negation processing in the particular groups.
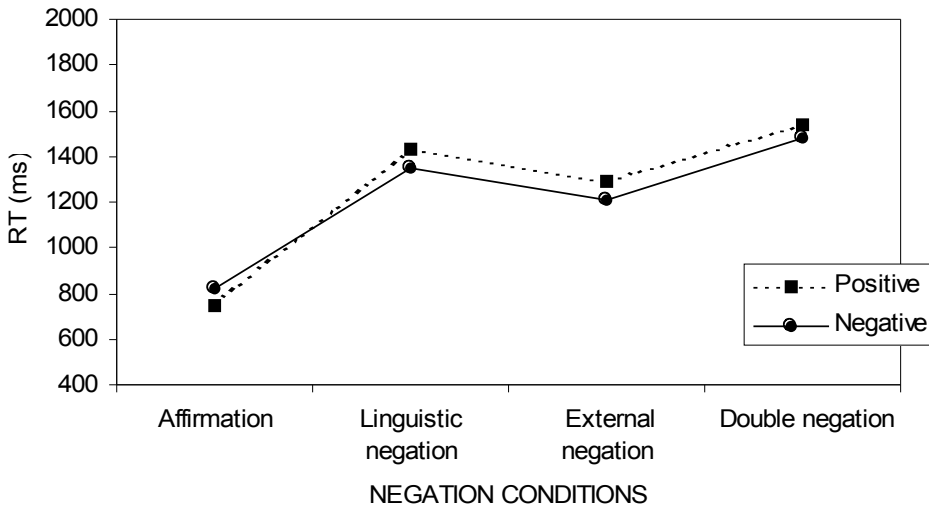
Classifying time in particular groups of participants

How dos the processing of adjective valence depend on negation conditions in the particular groups? In each of these three groups there was the main effect of negation conditions and a significant effect of the interaction of negation conditions and adjective valence. For Group no.1, the main effect was: $F(3, 75) = 26.5$; $p < 0.001$, $\eta^2 = 0.51$ and the interaction effect was: $F(3, 75) = 45.98$; $p < 0.001$, $\eta^2 = 0.64$. For Group no.2, the main effect was: ($F(3, 78) = 52.25$; $p < 0.001$, $\eta^2 = 0.66$), and the interaction effect was: ($F(3, 78) = 3.13$; $p < 0.05$, $\eta^2 = 0.10$). For Group no.3, the main effect was: $F(3, 81) = 31.01$; $p < 0.001$. $\eta^2 = 0.53$ and the interaction effect was: $F(3, 81) = 5.08$; $p < 0.01$, $\eta^2 = 0.15$.

In each of the three adjective groups – distinguished by the function of *not* or *in-* – there appeared a similar pattern of adjective classifying time depending on the kind of negation used: in every group the basic adjectives, i.e. not negated, were processed the fastest; processing of linguistic negation takes more time than processing of external negation. However, in Group no. 1, the difference between linguistic negation and external negation (without taking valence into consideration) was nonsignificant $t(26) = 1.56$; $p = 0.25$. The processing time for double negation did not differ significantly from the processing time for linguistic negation.

Recall that the interaction of negation conditions and adjective valence consists in the fact that, in the case of non-negated adjectives, positive ones are classified significantly faster than negative; on the level of linguistic negation and external negation adjectives in the NEGATIVE category are processed significantly faster than those in the POSITIVE category (when we average the result for the three kinds of adjectives); on the level of double negation there was no significant difference in classifying time with regard to their mark. This pattern of relation between positive adjectives classifying time and negative adjectives classifying time is similar for all the group types, but those differences are not significant everywhere. In Group no.1 (antonymous function of *not* or *in-*) the above mentioned differences in processing valence are statistically important for all the negation conditions: with no negation as well as with linguistic negation, external negation and double negation. For Group no. 2 (lexical antonyms), it is characteristic that using negation (lexical, external, double) does not make any significant difference in classifying time between positive and negative adjectives. In Group no.3 (uni-polar adjectives), this difference appears on the level of no negation and on the level of external negation. For all the groups, non-negated positive adjective classifying is significantly faster than non-negated negative adjective classifying.

We should emphasize the characteristic result in Group no. 2; here on the level of linguistic negation, external negation and double negation there is no significant difference between positive and negative adjectives classifying time. In the conditions of linguistic negation and external negation negative adjectives were classified

Figure 3. Classifying time – interaction of negation conditions and adjective valence in Group no. 2 (Experiment 1)
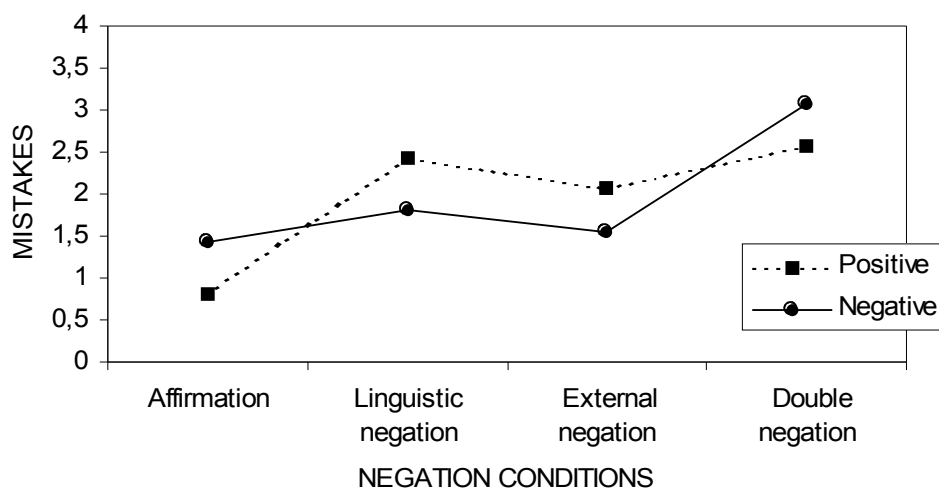

faster than positive but this difference was nonsignificant: for linguistic negation p = 0.061 and for external negation p = 0.078. This is illustrated in Fig. 3.

This slight difference between positive and negative adjective classifying time on the level of linguistic negation has, it seems, reasons of a semantic nature. The gradual function of *not* or *in-* means that the negated adjective has its place closer to the neutral state. In the case of Group no.1, i.e. adjectives whose negation creates the pole of antonymy, their valence is extremely positive or extremely negative, so that differences in processing them in relation to the given negation kind are greater. But this interpretation is more difficult to apply for external negation and double negation. As Lyons (1977) noticed, negation starts thinking in categories of pole opposition, e.g., an external negation of *rich* should start with an association with *poor,* i.e., another pole of the antonymy. So we could expect that, in the case of external negation, the difference between positive and negative adjective classifying time would be greater, and would call to differences obtained in the other two groups. However, that did not happen. I will come back to this question in the general discussion.

Classifying accuracy

In measuring adjective classifying time only the right reactions were taken into consideration. The second indicator of classifying difficulty was the number of mistakes made during the classifying task. Does faster classifying result in a greater number of mistakes, or the opposite, i.e., does difficulty in the given kind of negation processing manifest itself in longer classifying time as well as in a greater

Figure 4. Classifying mistakes – interaction of negation conditions and adjective valence (Experiment 1)

number of mistakes. There was the main effect of negation conditions (F(3, 234) = 21.45; $p < 0.001$, $\eta^2 = 0.21$); the fewest number of mistakes was found in classifying non-negated adjectives, then in adjectives linguistically negated. The greatest number of mistakes appeared with double negation.

As in the case of classifying rate, there is an interaction of negation conditions and valence (F(3, 234) = 8.14; $p < 0.001$, $\eta^2 = 0.09$). See Fig. 4.

The number of mistakes in adjective classifying depends on the kind of negation, while at the same time the impact of classified adjective valence differs in the different negation conditions. In the case of non-negated adjectives, (basic) positive adjectives are classified with fewer mistakes than negative ones. On the level of linguistic negation and external negation, adjectives of the NEGATIVE category are classified more correctly (with fewer mistakes) than those of the POSITIVE category. On the level of double negation an interesting inversion of tendency was noticed; here, a greater number of mistakes is generated by negative adjective classifying (t(81) = 1.89; $p = 0.062$), i.e., the relation between positive and negative adjectives starts to be similar (but with a definitely higher number of mistakes) to the relation appearing on the level of processing non-negated adjectives.

The three-way ANOVA showed also that the interaction of the two above mentioned factors changes depending on a third factor, i.e. the kind of adjectives distinguished on the *not* or *in-* function: F(6, 234) = 3.09; $p < 0.01$, $\eta^2 = 0.07$. In Group no. 1 (antonymous function of *not* or *in-*) there was a significant difference between the number of mistakes in classifying positive and negative adjectives with a significant interaction with the kind of negation. In Group no. 2 (gradual

not) there are no significant differences in classifying accuracy between positive and negative adjectives in the case of the four negation conditions. In Group no. 3 (uni-polar adjectives) only linguistic negation caused no differences in the number of mistakes. In Groups no. 1 and 2, the relation between negative and positive adjectives recalls our observation in the case of classifying time, and this demonstrates that time was connected with classifying accuracy.

Discussion

It should be emphasized that the distribution of errors made in the classifying task depending on negation conditions corresponds with the distribution of classifying time – longer times correspond with a greater number of mistakes. This means that both measured variables show a hierarchy of difficulty in adjective classifying depending on the kind of negation. Leaving an interpretation of the results for the final summary and discussion, we should pay attention to the results of the comparison of the adjective classifying with linguistic negation and external negation. It turned out that processing of words was faster and more accurate with external negation than with linguistic negation. This result was the most probable in the third group of participants where linguistic negation was non-lexical, and cognitive complexity seems to be more with the external negation. It turned out that, in the case of adjectives negated "lexically" (Group no.1 and Group no. 2), the linguistic negation was more difficult than the external negation. This result may be evidence of different mechanisms connected to encoding these two kinds of negation. However, it should be checked whether other accidental factors did not influence this result.

First, the faster and more accurate processing of adjectives negated externally than those negated linguistically could have been influenced by the effect of practice since the experimental series with the external negation took place after the series with linguistic negation and the participants had a longer "training" in word classification into two categories. Second, the external negation was tested in series where all the words appeared in red color, i.e., had the opposite meaning. It is possible that the participants discovered a simpler strategy of coping with the task than changing the meaning of every word into its opposite. They may have discovered that a simpler strategy is to imagine that the basic categories (POSITIVE – NEGATIVE) are set the other way round on the screen. Using this strategy would make the classifying task significantly easier. To test those possibilities modifications of Experiment 1 were designed. Replication of Experiment 1 – to check if the effect of practice influenced the above mentioned differences between the linguistic negation and the external negation – consisted in changing the order of the linguistic negation with the external negation (Experiment 2).

There was also designed a way of eliminating the hypothetical process that could have influenced the faster processing of the external negation – and that would consist not in changing the meaning of the words into the opposite but in

imagining that the basic categories are set the other way round. A new version of the experiment was designed (experiment 3) in which in a given series there appeared linguistically as well as externally randomly negated.

Experiment 2

The subject of experiment 2 was to check whether the order in the series in experiment 1 influenced the processing of external and linguistic negation. If easier processing of external negation resulted from practice in doing the classifying task in successive series, the result should change with the opposite order of these kinds of negation. This experiment checks the extent of replication of another result that shows the influence of the interaction of negation kind, word valence and kind of adjectives on classifying difficulty.

Method

Participants and Design

Sixty-two students (53 women and 12 men) of the Applied Psychology Institute of Jagiellonian University took part in the experiment. They were placed in three experimental groups: 20 people in Group no.1, 20 people in Group no. 2 and 22 people in Group no. 3. Participation in the experiment was voluntary and without payment. The experiment consisted of 3 (Kinds of Adjectives: adjectives with antonymous *in- (nie) vs.* adjectives with gradual *not (nie) vs.* uni-polar adjectives) x 4 (Negation Conditions: affirmative *vs.* linguistic negation *vs.* external negation *vs.* double negation) x 2 (Word Valence: positive *vs.* negative).

Materials and Procedure

The design was the same as in experiment 1 with three kinds of adjectives distinguished by the function of *not* or *in-* as a between-subject factor and word valence and four negation conditions as the within-participant factors. The same words were used in the classifying task. The only difference consisted in changing the order of the series connected with linguistic negation and external negation; the external negation appeared now in part II (series 3 and 4) and preceded the linguistic negation used in part III (series 5 and 6). Similarly, as in experiment 1 basic adjectives were exposed in part I (series 1 and 2) and double negation appeared in part IV (series 7 and 8). In every series there appeared randomly 18 stimuli words – 9 positive and 9 negative – preceded by two training words whose classifying time was not included in the results.

Results

Incorrect responses (6.1%) and the two first responses in each block were excluded from analyses. To assess if the order of the linguistic negation and external

negation series exposition influenced the difficulty in their processing, the results of experiment 1 and experiment 2 connected with these two negation kinds were compared. There was included one more inter-group factor, i.e., the order of these two negation kinds in the series in the case where the linguistic negation series precedes the external negation series (experiment 1) and the opposite case (experiment 2). This conclusion is supported by the results of a 3 (Adjective Kind) x 2 (Order of Linguistic Negation and External Negation Series Exposition) x 2 (Valence) x 2 (Negation Conditions) ANOVA. The direct way to check if the observed difference between linguistic negation and external negation was influenced by the order of the series in experiment 1 is by referring to the order factor in the variable analysis. It turned out that the order of these two kinds of negation did not influence the classifying time $F(1, 137) = 0.001$; $p = 0.977$. There was no interaction of this variable with the rest of the factors, so we can exclude the supposition that the slower processing of linguistic negation than of external negation in experiment 1 was connected with their order and the effect of practice.

A similar test was done for the variable Classifying Accuracy. For the results of linguistic negation and external negation processing from experiments 1 and 2 there was a four factor analysis made with exactly the same scheme as for classifying time. It turned out that the order of the two negation conditions did not influence significantly the number of mistakes, $F(1, 137) = 0,0035$; $p = 0,85$, and there was no interaction with the other factors registered. Thus, the conclusions from the analysis of classifying time are proved and exclude the possibility that the order of series (the effect of practice) influenced the differences in linguistic negation and external negation processing.

Experiment 2 enabled us to check if the pattern of results connected with all the variables would be confirmed. To check that for the experiment 2 classifying time there was a variable analysis conducted the same as in experiment 1 (the plan 3 x 4 x 2). There was a very similar pattern of results. A 3 (Adjective Kind) x 4 (Negation Conditions) x 2 (Word Valence) ANOVA revealed a significant three-way interaction, $F(6, 177) = 4.13$; $p < 0.001$, $\eta^2 = 0.12$). Especially the main effect of negation conditions $F(3, 177) = 54.95$; $p < 0.001$, $\eta^2 = 0.48$) and an interaction of negation conditions and adjective valence $F(3, 177) = 19.01$; $p < 0.001$, $\eta^2 = 0.24$ showed almost the same pattern of results as in experiment 1. Also, the analysis of classifying mistakes brought – in spite of the changed order of the two negation kinds – a replication of the results of experiment 1.

Experiment 3

Another possible explanation for the faster processing of adjectives with external negation than with linguistic negation is the observation that external negation was investigated in the series where every word appeared in red – the color indicating the opposite meaning of the adjective. It could be that participants discovered an

easier strategy for coping with the task than changing the meaning of each word into its opposite. They might have perceived that an easier strategy was to imagine that the basic categories (NEGATIVE – POSITIVE) were set on the screen in opposition to each other. If this operation was done, it would significantly facilitate the classifying task and thus the external negation would be connected with shorter classifying time than the linguistic negation. In order to eliminate such an option we designed a new version of the experiment where in a particular series externally and linguistically negated words appeared in random order.

Method

Participants and design

Eighty-nine students (30 men and 59 women) of the Public Affairs Institute and the Applied Psychology Institute of the Jagiellonian University took part in the experiment. They obviously were not the same people as in Experiment 1 and Experiment 2. Group no.1 consisted of 40 participants, Group no. 2 of 25 participants, and Group no. 3 of 24 participants. Students participated in the experiment voluntarily and were not paid. The experiment consisted of 3 (Kind of Adjectives: adjectives with antonymous *in- (nie) vs.* adjectives with gradual *not (nie) vs.* unipolar adjectives) x 2 (Negation Kind: linguistic negation *vs.* external negation) x 2 (Word Valence: positive *vs.* negative).
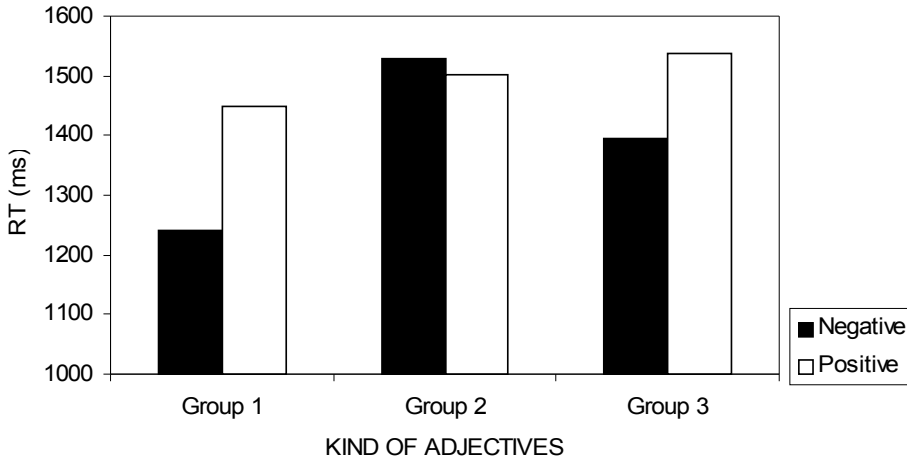
Procedure

This time two series were used that differed with setting the basic categories on the screen. In each of the series, linguistically and externally negated words appeared on the screen in random order. All the adjectives were negated externally and linguistically; if in the first series an adjective was negated externally, it was linguistically negated in the second series, and vice versa. In each series, 18 stimulus words (9 positive and 9 negative) appeared in random order and before all of them in each series participants were shown 2 training words. The classifying times for the training words were not included in the analysis.

Results

Incorrect responses (5.6%) and the two first responses in each block were excluded from analysis. ANOVA revealed the main effect of Negation Kind, $F(1, 86) = 14.68$; $p < 0.001$, $\eta^2 = 0.14$); classifying in the case of linguistic negation took more time than in the case of external negation. The results of the former experiments were thus confirmed, and causes other than the very nature of the two types of negation - causing that classifying the external negation is an easier task than the linguistic negation - could be excluded.

An interaction of Negation Kind and Adjectives Kind was also observed, $F(2, 86) = 5.26$; $p < 0.01$; $\eta^2 = 0.10$; in the group of adjectives with antonymous function

Figure 5. Classifying time – interaction of Adjective Kind and Adjective Valence (Experiment 3)

Group 1 - adjectives with antonymous *in- (nie)*
Group 2 - adjectives with gradual *not (nie)*
Group 3 - uni-polar adjectives

of *not* or *in-*(Group no.1) both negation types were processed in similar time. The result of Experiment 1 and Experiment 2 was thus repeated; also the differences in classifying time between the two negation types were not observed in Group no.1.

The main effect of Word Valence was also revealed; adjectives that belonged to the NEGATIVE category were classified faster than adjectives belonging to the POSITIVE category, $F(1, 86) = 27.87$; $p < 0.001$, $\eta^2 = 0.24$. A confirmation of the discovery that in the case of the two negation types (linguistic negation and external negation) participants process adjectives belonging to the NEGATIVE category faster than adjectives belonging to the POSITIVE category was obtained as well in a modified version of negation exposure. The effect of interaction between Adjective Kind and Word Valence ($F(2, 86) = 11.58$; $p < 0.001$, $\eta^2 = 0.21$) was shown in the fact that (in contrast to the other groups) there were no differences in classifying time with respect to adjective valence. This is illustrated in Fig. 5.

Experiment 3 also confirmed the former results referring to the interaction of adjective kind and their valence; in the group of adjectives with the gradual function of *not* or *in-* (Group no.2), their valence did not differentiate classifying time.

An analysis to classify mistakes was also conducted. The main effect of Adjective Valence was observed, $F(1, 86) = 9.31$; $p < 0.01$, $\eta^2 = 0.09$; adjectives in the POSITIVE category classifying were connected with a greater number of mistakes than classifying in the second category. Thus, here as well the regularity was confirmed that longer classifying times go hand in hand with a greater number of mistakes.

Discussion

New conditions of linguistic and external negation exposition confirmed the results obtained before that: a) classifying in the case of linguistic negation takes more time than in the case of external negation, but this does not refer to the adjectives with the antonymous function of *not* or *in-*; b) linguistically as well as externally negated adjectives that belong to the NEGATIVE category are processed faster than adjectives that belong to the POSITIVE category, but does not concern adjectives with the gradual function of *not* or *in-*.

Therefore we can exclude the presumption that faster processing of external negation in Experiments 1 and 2 resulted from a special strategy consisting in the fact that instead of changing the meaning of words participants imagined that the basic categories were set on the screen opposite to each other. In Experiment 3, the possibility of using a strategy of that kind was eliminated and in spite of this fact the effect of difference between linguistic and external negation was confirmed.

General discussion

Conclusions and discussion referring to the presence of negation

The main effect of negation that was obtained in all 3 experiments indicates that, in comparison with the basic adjectives, the presence of any type of negation determines higher processing difficulty: classifying time is lengthened and the number of mistakes is greater. Non-negated adjectives are processed significantly faster and more correctly than adjectives negated linguistically, externally or doubly – irrespective of adjective kind and valence. It confirms the markedness theory by which an element of negation increases the cognitive complexity of words.

A practical conclusion can be drawn from this fact. In order to make information comprehensible, easily understood and, in order to avoid mistakes in communication, usage of the name negation should be reduced. Despite the fact that this type of negation can be found in everyday communication and it would seem that negated adjectives have the status of independent lexical units, they increase difficulty in information processing and increase the number of communication mistakes.

An interesting conclusion drawn from the results is that, in the two groups of adjectives, the linguistic negation processing is a more complex task than the external negation processing (longer word classifying time and a greater number of mistakes). This conclusion, which is very interesting from the theoretical and practical points of view, is based on the coherency of results of the whole series of experiments. Adjectives negated with the word *not* are processed more slowly and they generate more classifying mistakes than the same words negated in a non-lexical way. However, this does not concern the group of adjectives with the antonymous function of *not* or *in-* . In this case there is no difference between linguistic negation and external negation in processing difficulty.

It seems that in Group no. 2 (lexical antonyms) and in Group no. 3 (uni-polar adjectives) it was caused by different factors. In both groups, externally negated adjectives were processed faster than linguistically negated adjectives. The relatively biggest difference between the linguistic negation and the external negation occurred in the group of uni-polar adjectives (Group no. 3). This result was consistent with our expectations. Linguistic negation in this case required processing words with "added" morphemes *not* or *in-*, which rarely appear in common communication. Hence the greater classifying task difficulty in comparison to external negation, when the red color was the signal to change the adjective valence into the opposite.

Also in the case of lexical antonymy poles (Group no. 2) a relatively greater facility in processing external negation was observed. External negation was confined to the very signal of an opposite meaning of a word and it activated only one process – the process of valence changing of a particular adjective into its opposite. In the case of linguistic negation, which functions as relative gradation in this group, the word *not* or *in-* was more than a simple signal to cancel the meaning of a basic word or an indication to change its meaning into the opposite. It also contains information about the intensity of a particular feature and by this increases the semantic complexity of the negated adjective. Moreover, on an axis of *negative-positive* dimensions a gradually negated adjective occupies a position that is closer to neutral states, which can also make classifying decision more difficult. This could suggest that external negation is more likely to activate a way of thinking based on polar opposition than on linguistic negation, although other results lead us to suppose that in the case of external negation as well its gradual function gets activated.

The greater difficulty in linguistic negation processing in comparison to external negation leads also to the conclusion that negated adjectives do not function as completely autonomic words that are at once encoded in their exact meaning. If they functioned like that, the external negation would take more time, because it requires changing the meaning of the word into its opposite. Nor does this happen in the group of adjectives with the antonymous function of *not* or *in-* (Group no. 1); in all the experiments there was no difference observed between linguistic and external negation in the case of adjectives where to which *not* or *in-* has the antonymous function. An adjective negated with *not* or *in-* is the second pole of antonymy here. We can say that in this case *not* or *in-* is the signal that brings out the opposite meaning as does external negation. Therefore this type of negated adjective is also not encoded as an autonomic semantic unit, since their categorization does not take less time than does external negation.

Double negation processing takes approximately as much time as linguistic negation processing (although it results in a greater number of classifying mistakes) which bears testimony to the strategy of coping with the task by canceling both negation marks (it seems that the logical rule of double negation worked here) which is not always in force .

Conclusions and discussion on processing adjectives with different affective value

A few strong conclusions were also drawn with reference to adjective valence processing. A significant interaction of adjective valence and negation conditions was observed. In the case of no negation, positive adjectives are classified faster and more correctly than are negative ones. This refers to all types of adjectives. Selection of the three groups of adjectives allowed us to investigate the time of recognizing basic adjective valence (not negated linguistically) irrespective of markedness. As far as in Group no. 2 (different-stem antonymy) the majority of negative adjectives are marked (they contain a hidden element of negation), so the slower classifying may be explained by their greater cognitive complexity. In the remaining two groups either non-marked elements can be found (Group no.1, one stem antonymy) or adjectives are not the elements of opposition (Group 3, uni-polar adjectives). In connection with this, classifying time can be directly linked to the issue of word valence. Therefore, irrespective of cognitive complexity, the valence affects processing difficulty - irrespective of non-negated adjective semantic complexity, the positive ones are processed more easily than the negative ones (in confirmation of Osgood's thesis). This result can be considered in the context of the so-called informational effect of negativity (Peeters and CzapiDski, 1990) which lies in focusing greater cognitive activity on negative stimuli and processing them more deeply, which probably has an influence on classifying time lengthening.

In the case of linguistic negation, negative adjectives are classified more easily than positive adjectives (Osgood's thesis is thus not in force here), however, it is not only the issue of cognitive complexity that determines it. In the case of Group no. 2, negated positive adjectives are more semantically complex than negative adjectives, because they contain the linguistic negation and the logical negation (the expression *not bad* is more complex than *not good*), in the case of Groups no. 1 and 3 there is no such connection and the difference in processing facility of affectively negative adjectives is greater than in Group no. 2.

An interesting influence (and interaction) of cognitive complexity and valence on processing was observed. It cannot be said that one of these factors is more important or that they overlap (i.e. that markedness and negativity are concurrent). Semantic complexity influences the classifying. The best evidence of this is the fact that basic adjectives, irrespective of their tags, are processed faster than negated adjectives. However, on the level of three negation conditions the adjective valence influences processing speed and accuracy. The manner of group selection excludes the possibility that words in category POSITIVE are always more complex and, in consequence, processed more slowly and less correctly than words of the second category. It seems that, in the case of linguistic negation, the faster classifying of non-negated adjectives was influenced by the so-called greater productivity of

positive words and, in consequence, greater frequency of negatively valued negated adjective occurrence. It can also be presumed that it is the negation tag the word *not* or *in-* (more than cognitive complexity) that determines the greater difficulty of positive adjective processing. This is because *not* or *in-* is associated with something negative: refusal, untruth, disagreement, etc. So adjectives that begin with *not* or *in-* activate negative meaning more easily than positive.

We can also draw a pragmatic conclusion. If we process affectively negative negated adjectives more easily (faster and with fewer mistakes) than positive adjectives by using negated adjectives of given valence, we can emphasize human negative features more strongly with affectively negative negated adjectives than his or her positive features with positively valenced negated adjectives. It is easier to process negative information that someone is *dishonest* than positive information that someone is *not guilty*).

There is also an interesting conclusion referring to external negation. It turns out that with a non-verbal signal (red color) it is easier to change a positive valence into negative than a negative valence into positive. Basic adjectives touched with the non-verbal negation were assigned to the negative rather than to the positive category faster and more correctly. Therefore it is easier to change the valence of the word *moral* into negative than to change the valence of the word *guilty* into positive. This result can be also interpreted in the context of the informational effect of negativity that has been mentioned above. When positive stimuli (that have less informational value) attract less attention, in their case one could start the negation operation faster, which leads to faster classifying of this type of stimuli.

Can the latest result be referred to the practice of communication? Is the non-verbal signal that questions the truth of a particular statement perceived more easily when it changes the positive meaning of a statement into negative, than when it changes its negative meaning into positive? If the above results are confirmed in the case of sentence negation, such suppositions would become more important, for the question could be asked: what would be the pattern of results if the external and the linguistic negation referred not to single words but to whole sentences? Would the external negation be processed faster than the linguistic negation and stimuli belonging to the NEGATIVE category processed faster than stimuli belonging to the POSITIVE category? An answer to these questions will be sought in an experiment in which, on the basis of Experiment 1, whole sentences (and not single words) will be used as material to be negated and classified.

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