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Majority and minority influence, task representation and inductive reasoning

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One hundred and fifty-five participants had to solve a set of 2–4–6 like reasoning problems (Wason, 1960), in which they were told which hypothesis a majority (or a minority) proposed, as well as which example was used for the test. In a 2 × 2 design, participants were also told that the problems allowed either one single correct answer or several possible answers. Results show that, when the source is a majority and the problem allows one single answer, most participants adopt the source's hypothesis and use confirmatory testing. On the contrary, it is when the source is a minority and the problem allows several answers that most participants give alternative hypotheses and use disconfirmation.

Why is lay people's reasoning so frequently 'incorrect'? This question can arise if one takes into account the large amount of work showing how many errors and biases occur in human reasoning (cf. Caverni, Fabre & Gonzales, 1990). Research has shown evidence of the existence of biases in inductive reasoning (e.g. Mynatt, Doherty & Tweney, 1977), deductive reasoning (e.g. Evans, 1982), statistical reasoning (e.g. Kahneman, Slovic & Tversky, 1982) or decision making (cf. Legrenzi, Girotto & Johnson-Laird, 1993). This article aims to show that, beyond the opposition between biases and correct (or valid) reasoning, it is important to consider that cognitive mechanisms in reasoning can be adapted to the social reality into which individuals are inserted while solving a problem. It is therefore important to consider not only the cognitive difficulties that individuals can experience during problem solving, but also any models or examples they may refer to, the dynamics of conflict to which they may be exposed, as well as the representations of the task activated by the specific situation. The following experiment is part of a research programme (cf. Butera, Legrenzi, Mugny & Pérez, 1991–92; Pérez & Mugny, 1993) that treats the above matters by studying the effects of social influence on inductive reasoning and in particular on the so-called 'confirmation bias'.

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The confirmation 'bias'

Wason's seminal work (1960) showed a gap between the logical requirements of a reasoning task and the cognitive mechanisms actually intervening in reasoning. He pinpointed that individuals strongly tend to confirm hypotheses: participants asked to find the rule underlying a number triad (2–4–6) failed to test their hypothesis (e.g. ascending even numbers) by proposing triads that could lead to hypothesis disconfirmation (e.g. for the above hypothesis, 3–5–7). Yet, disconfirmation enables elimination of just-sufficient hypotheses and thus represents more of a diagnostic strategy to proceed towards the discovery of a more general hypothesis (McDonald, 1990).

In the last 30 years the '2–4–6' task became a reference point for the study of inductive reasoning. Scholars oriented the research towards a 'debiasing' approach: finding the rationale for this bias (the use of confirmation) by discovering what conditions eliminate it. Evans (1989, ch. 3) gives a good discussion of the work pointing out the confirmation bias and of the work trying to reduce it. His literature analysis underlies two mainstreams in confirmation bias explanations. The first one (e.g. Mynatt *et al.*, 1977) gives a motivational explanation: subjects are motivated to verify their hypotheses rather than to falsify them for reasons related to self-consistency, 'vanity and maintenance of the beliefs structure' (Evans, 1989, p. 42). The second one (e.g. Evans, 1989) proposes that the confirmation bias rests on a more general positivity bias: 'cognitive difficulty in thinking about any information which is essentially negative in its conception' (Evans, 1989, p. 63).

Then, as Legrenzi & Legrenzi (1991) pointed out, several researchers consider hypothesis confirmation as an error, a bias or as a cognitive limitation. This tendency appears more clearly when considering the literature on deductive reasoning. In these tasks it is indeed easier for the researchers to treat problem solving in terms of correctness: in deductive reasoning, disconfirmatory testing is logically necessary, whereas for inductive reasoning it is 'merely' diagnostic. Faced with the persistence of confirmation in reasoning experiments, authors mainly tried to make the tasks more intelligible (Legrenzi & Legrenzi, 1991) by linking the solution to familiar knowledge (e.g. Griggs & Cox, 1982) or by inserting it in pre-existing cognitive structures (e.g. Cheng & Holyoak, 1985; Cosmides, 1989; Girotto, 1991).

Majority and minority influence in inductive reasoning

It rarely happens that a hypothesis is formulated and tested in a social void, in the absence of alternative models with which to compare it; on the contrary, scientific thinking (the 2–4–6 task has traditionally been used as the prototype of scientific thinking) is typically inserted in a network of social influences (Moscovici, 1993). A psychosocial approach to the problem of reasoning biases would be to study hypothesis formulation and testing within the dynamics of social influence, as reasoning most frequently occurs when confronted with other people.

The social psychology of influence has shown that exposure to a majority's model or proposal induces conformity (Moscovici, 1985) and cognitive functioning of a convergent type, i.e. confined to the use of information at hand (Nemeth, 1986; Nemeth, Mosier, & Chiles, 1992). This means that the presence of a majority's proposal would induce participants to use the source's hypothesis when formulating their own. Convergent thinking should then orientate participants' reasoning to take into account only the characteristics of this hypothesis and its elements; thus, it is likely that participants, when testing the hypothesis, would formulate positive examples, i.e. examples that are compatible with the hypothesis under test. In short, participants would be oriented towards the use of confirmation in social situations characterized by a consensus expectation leading to conformity to the majority.

Furthermore, research in social influence has shown that, when a model is given by a minority source, participants are not motivated to adopt it (Moscovici, 1980), as the source does not guarantee the validity of its proposal (Nemeth, 1986). Thus, in a problem-solving task, where participants must come to a reliable solution, it is impossible to trust a minority source when assessing a judgement. The notion of divergent thinking (Nemeth, 1986) is then useful to account for the cognitive processes occurring during problem solving when faced with a minority source. On the one hand, 'minorities stimulate a greater consideration of other alternatives' (Nemeth, 1986, p. 25); in fact, several studies showed that confrontation with a minority source actually induces a search for alternatives (De Dreu & De Vries, 1983; Nemeth & Kwan, 1985, 1987; Volpato, Maass, Mucchi-Faina & Vitti, 1990). Moreover, a study of Huguet, Mugny & Pérez (1991–1992) suggests that minority influence implies an activity of decentration, i.e. the induced possibility of taking into account several points of view when formulating a judgement. As for the formulation of a hypothesis, it is thus legitimate to think that individuals confronted with a minority's proposal would be less motivated to adopt it and would then be led to choose or formulate alternative hypotheses.

On the other hand, from the information-processing point of view, individuals exposed to minority influence 'are stimulated to attend to more aspects of the situation' (Nemeth, 1986, p. 25), a mechanism related to the fact that, facing a minority, individuals would consider the task as being of greater complexity (Zajonc, 1960), as demonstrated by several studies (e.g. Nemeth, Mayeseless, Sherman & Brown, 1990). Nemeth suggests furthermore (1986, p. 28) that divergent thinking leads to a kind of information processing that can be described as more systematic (a comprehensive, analytic orientation to information processing, cf. Chaiken, 1980) or more central (Petty & Cacioppo, 1986). The same idea underlies Moscovici's notion of validation; this refers to the fact that confrontation with a minority source leads to a greater focusing on the object (Personnaz & Guillon, 1985; Tesser, Campbell & Mickler, 1983) in order to check the validity of one's own judgement as well as that of the minority's judgement (Moscovici, 1980, p. 215), but also in order to check the limits of validity of a judgement (Mugny, Butera, Pérez & Huguet, 1993). This implies that, as for hypothesis testing, minority influence induces such mechanisms that allow questioning the limits of validity of a hypothesis, and therefore the use of negative examples in hypothesis testing, i.e. examples that are not compatible with the hypothesis under test;[1] this should favour the use of disconfirmation. Thus, the possibility of considering the existence of alternative hypotheses gives to disconfirmation its necessary condition: the possibility of imagining a replacement solution (it would be absurd to test through disconfirmation the only available hypothesis). In

[1] In another theoretical frame, a similar hypothesis is made by Frey (1986): a low credibility source induces less selective exposure to consonant information and allows the search for contradictory information.

short, individuals would be oriented towards the use of disconfirmation in social situations where the existence of possible solutions is elicited by the opposition between one's own hypothesis (which it is not necessary to give up for conformity reasons) and the minority alternative hypothesis.

In a preliminary study (Legrenzi, Butera, Mugny & Pérez, 1991), participants were to discover the rule underlying a given number triad (e.g. 2–4–6). They were asked to formulate a hypothesis and to propose a number triad for testing it, after having been informed of the hypothesis ('each new number is greater than the previous one') and of the triad proposed by either a majority (82 per cent) or a minority (12 per cent) of people who had already participated in the study. The triad proposed by the source was either confirmatory (e.g. 8–10–12) or disconfirmatory (e.g. 12–10–8) with respect to the source's hypothesis. As for the formulation of hypotheses, results of the influence phase show that more participants used the source's hypothesis. As for the formulation of hypotheses, results of the influence phase show that more participants used the source's hypothesis in the majority conditions (even if it was in order to reformulate it), whereas post-test results show that more participants formulated completely new hypotheses when the minority used a confirmatory strategy. As for the hypothesis testing strategies, although confirmation was in all conditions the dominant strategy, more participants used disconfirmation when this strategy was proposed by the source (which is in line with the results of Gorman & Gorman, 1984). More importantly, when the source proposed confirmation for testing hypotheses, participants confronted with a majority almost never used disconfirmation, whereas participants confronted with a minority (those who proposed the highest rate of completely new hypotheses) formulated disconfirmatory triads more than majority condition participants, although disconfirmation was proposed neither by the source, nor by experimental instructions.

In another experiment (Butera & Mugny, 1992), source's correctness was manipulated; in half of the conditions the solution that the source allegedly discovered was adequate, whereas in the other half it was supposed to be wrong. Overall, fewer participants logically chose the erroneous answer. However, a majority induced more hypotheses derived from its own as well as more confirmatory examples than a minority did, and this regardless of correctness; moreover, minority induced more participants to formulate completely new hypotheses and to use disconfirmatory testing (although confirmation was still more frequent), again regardless of correctness. If these dynamics do not depend on the source's closeness to 'reality', then on what do they depend? The hypothesis developed here is that these effects are ruled by some correspondence between the nature of the source and the representation of the task.

Social influence and the representations of the task

Brandstätter *et al.* (1991) recently argued that a majority source would induce a representation of the social influence situation in terms of a pressure towards uniformity that would limit the choice of parameters to take into account when solving a task; therefore its influence would depend also on the representation of the task. In other words, a majority source induces a representation of the task in terms of unity (i.e. as necessitating a single solution) for consensus is necessary. Such a representation puts the majority in the position of a reliable source of information; this entails, in this paradigm, a substantial use of the majority's hypothesis. The deriving focus necessitates a strategy of hypothesis testing that *a priori* does not invalidate the hypothesis: confirmation.

According to Brandstätter *et al.* (1991), a minority judgement does not induce pressure towards uniformity—it even represents the possibility of divergence—and would introduce a certain pluricity in the parameters that can be taken into account when solving a task. This is evident in the fact that, in this paradigm, more participants formulate new rules when the source is a minority (see also Nemeth & Kwan, 1987). A minority source thus creates a representation necessary for the use of disconfirmation, as invalidation of a hypothesis necessitates the concern with the validity of at least another one (cf. Gorman & Carlson, 1989; Green, 1990; McDonald, 1990).[2]

The present experiment tests the hypothesis that a majority source induces more yielding and more confirmation because it produces a representation of the task in terms of unity, and that a minority source induces the consideration of alternative hypotheses and the use of disconfirmation because it produces a representation of the task in terms of pluricity. In a 2 × 2 design, the first variable concerns the nature of the source (either a majority or a minority) and the second the representation of the task. As for this variable, participants were told that the task allowed either one single correct answer (unity) or several possible answers (pluricity). The nature of the source should induce differential effects, in line with previous experiments; similarly, the representation of the task should induce differential effects too, as it is supposed to be the mediating variable accounting for the source's effects.[3] Thus, specific predictions concerning the correspondence between the nature of the source and representation of the task are that, confronted with a majority, participants will engage in more yielding to the source's hypothesis and in more confirmation when the majority nature of the source is in correspondence with an explicit representation of the task as calling for a single answer. Moreover, confronted with a minority, participants will engage in a greater use of alternative hypotheses (different from those of the source) and in more disconfirmation when the minority nature of the source corresponds to an explicit representation of the task as allowing a certain diversity of solutions.

Method

Procedure

One hundred and fifty-five high school students (median age = 19), with a similar proportion of males and females, volunteered to participate in the experiment. Twelve of them did not answer the third problem and were dropped from its analyses. Participants were given a questionnaire in which two problems were pre-

[2] It is worth noting that in these studies disconfirmation is considered as a constructivist effect (cf. Mugny & Pérez, 1988). The reason is that disconfirmation is not a testing strategy that can be found in the experimental situation (either in the experimenter's proposal, as in Gorman & Gorman, 1984; or in the source's proposal, as in Legrenzi *et al.*, 1991); moreover, disconfirmation is not a frequent strategy (as pointed out in the Introduction). Thus, inducing disconfirmation is considered as a constructivist effect because participants are led to elaborate mentally new characteristics of the problem, and new forms of reasoning, beyond the source's proposal and their previous socio-cognitive functionings. Let us also note that this definition meets what is called constructivism in the studies about socio-cognitive development (cf. Doise & Mugny, 1984).

[3] This hypothesis is also supported by the results of a research tradition that shows that the representation of the task has a determinant effect on problem solving (Abric, 1971) especially when social relations inside a group match the model of the task (Flament, 1965).

sented, concerning the organization of a 'visit three cities' tour proposed by a Swiss travel agency. All were given a map in order to be sure that they would know the exact location of all the cities.

The two problems asked participants to find the criterion underlying a triad of the most chosen cities, so that the agency could plan new three-cities tours that would be as successful as the first one (Genève, Lausanne, Lucerne, in the first problem; Neuchâtel, Montreux, Zürich, in the second one). Thus, all were Swiss cities on a lakeside.

Participants were informed that some employees of the agency (either a large majority, or a small minority) thought that the criterion was 'three swiss cities'; the same criterion was proposed for the two problems in order to ensure the source's consistency. Moreover, participants were told which triad of cities the employees decided to propose in a poll designed to test if their criterion was adequate. These triads were Lugano, Nyon, Brienz, in the first problem; and Vevey, Zoug, Spiez, in the second one. It is worth noting that these examples are compatible with the criterion the employees proposed, as for each example the three cities are Swiss. In other words, the employees always used a confirmatory strategy to test their hypothesis (in Legrenzi *et al.*'s 1991 experiment, differential effects of majority and minority influence appeared when the source used a confirmatory testing).

After having read the employees' criterion as well as the example for hypothesis testing, participants answered the two steps of the problem. First they had to choose the criterion that they believed underlay the success of the proposed triad of cities. The questionnaire proposed two choices: the source's criterion and another one (three cities by the water), also compatible with the initial triad. Second, they had to choose a triad of cities among four triads. The first one was a positive example of the two criteria presented above (three Swiss cities by the water); the second one was a negative example of the first criterion and a positive example of the second criterion (not all cities were Swiss, but all of them were by the water); the third one was a positive example of the first criterion and a negative example of the second (all cities were Swiss, but not all of them were by the water), and the fourth one was a negative example of both criteria (the three cities were neither Swiss, nor by the water). Thus, participants had two examples to confirm and two examples to disconfirm the chosen criterion, whatever the choice. At the end of each problem, a further question asked the participants what other triad they would have chosen if they had the opportunity to propose a second one.

Next the participants were asked some questions, using seven-point scales, about their representation of the task. The last page of the questionnaire proposed a more abstract problem (cf. Legrenzi *et al.*, 1991): the participants had to discover the rule underlying a triad of numbers (3–11–23 in all conditions). This problem asked open-ended questions, so that the participants had to formulate by themselves first a hypothesis, then a triad of numbers aiming to test it. Before they could answer, they read the hypothesis (ascending numbers) formulated by either a majority or a minority of people who had supposedly answered the questionnaire before. The participants also read the triad these people used to test their hypothesis, 5–13–35, a confirmatory example of the proposed hypothesis. This problem, presented as an additional exercise, allows a test of the experiment's hypotheses on more abstract material and an analysis the answers that the participants formulated by themselves.

Experimental design

The first independent variable is the type of source: it was presented as 'a large majority' of employees to half of the participants and as 'a small minority' to the other half. The second independent variable refers to the induced representation of the task. Half of the participants (representation of unity) were told that the problem allowed 'one single correct solution', and in all the questionnaires it was said that participants had to find 'the adequate criterion'. The other half of the participants (representation of pluricity) were told that 'several correct solutions' were possible, and it was said that they had to find 'one of the adequate criteria'. The four experimental conditions will be referred to as majority/one, majority/several, minority/one, minority/several.

Results

Results are presented by separating those concerning the choice of hypotheses from those concerning the hypothesis testing; first will be shown the results of the two exercises where a choice was imposed, then the results of the open-ended questions exercise.

Choice of hypotheses

In order to account for the results of the first two exercises (very similar when considered separately), a three-level measure has been computed, indicating if participants chose the source's hypothesis twice (three Swiss cities), once, or if they chose the other hypothesis twice (three cities by the water). In the first case participants completely adopted the source's hypothesis; in the third case they systematically avoided it. Figure 1 shows the mean frequency of yielding to the source.

Analysis of variance on this measure shows a main effect of the source ($F(1,151) = 40.672$, $p < .001$), a main effect of the representation of the task ($F(1,151) = 42.310$, $p < .001$), as well as an interaction between the two variables ($F(1,151) = 5.887$, $p < .017$), as represented in Fig. 1. This indicates that in the majority/one condition ($M = 1.74$, SD = 0.63) yielding is by far the most frequent; this condition differs from the majority/several condition ($M = 0.74$, SD = 0.66; $t(151) = 6.300$, $p < .001$) and from the minority/one condition ($M = 0.78$, SD = 0.82; $t(151) = 6.319$, $p < .001$). Moreover, the minority/several condition ($M = 0.32$, SD = 0.63) differs from the minority/one condition ($t(151) = 2.572$, $p < .011$) and from the majority/several condition ($t(151) = 2.914$, $p < .004$).

Hypothesis testing

In the first two exercises, participants had to choose a triad of cities in order to test their hypothesis; they were also asked what other triad they would have chosen if they had the opportunity to propose a second one. Thus, they could test their hypothesis twice in each exercise. Figure 2 shows the mean frequency of disconfirmation.

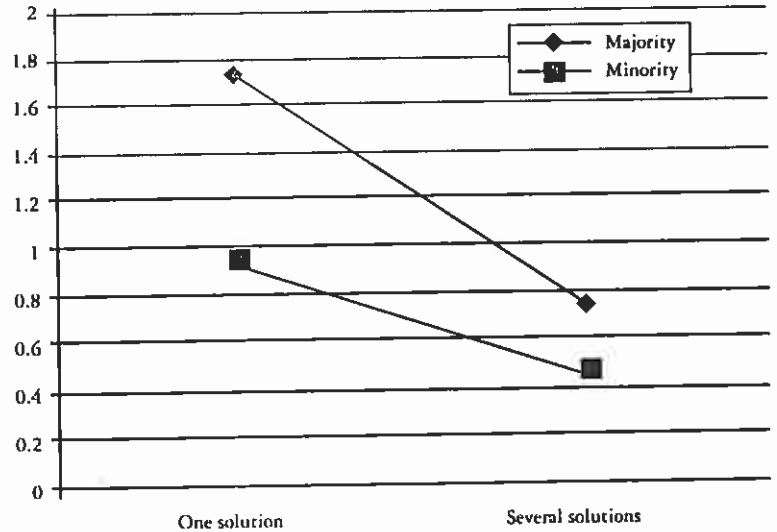

Figure 1. Mean frequencies of yielding in the first two exercises.

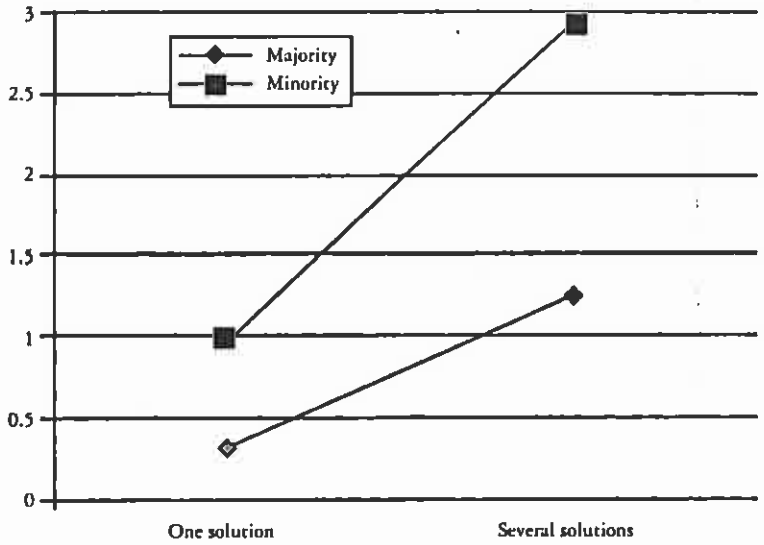

Figure 2. Mean frequencies of disconfirmation in the first two exercises.

Analysis of variance on this measure (0 to 4 disconfirmations) shows two main effects (source: $F(1,151) = 44.828, p < .001$; task: $F(1,151) = 73.162, p < .001$), as well as an interaction between the two variables ($F(1,151) = 9.234, p < .003$). This indicates that in the minority/several condition, disconfirmation is by far the most frequent ($M = 2.97$, $SD = 1.14$); this condition differs from the minority/one condition ($M = 0.98$, $SD = 1.11$; $t(151) = 8.215, p < .001$) as well as from the majority/several condition ($M = 1.26$, $SD = 1.20$; $t(151) = 6.786$; $p < .001$). Moreover, the majority/one condition ($M = 0.31$, $SD = 0.84$) differs from the majority/several condition ($t(151) = 3.861$; $p < .001$) and from the minority/one condition ($t(151) = 2.829$; $p < .005$). It is worth noting that in the minority/several condition the usual proportion of confirmation and disconfirmation is reversed (mean disconfirmation represents 74 per cent of the testing strategies): the 'confirmation bias' is thus counterbalanced.

Self-generated hypotheses and hypothesis testing

As the third exercise allowed open-ended questions, we classified participants' answers according to the distinction made by the Legrenzi *et al.* (1991) study: (*a*) the proposed hypothesis is the same as that of the source (ascending numbers), which refers to yielding *stricto sensu;* (*b*) the proposed hypothesis is a reformulation of that of the source, i.e. the participants include the source's hypothesis but they add some sort of specification (e.g. ascending even numbers); (*c*) the proposed hypothesis is completely new, i.e. it does not share any element with the source's hypothesis (e.g. numbers with less than three digits).

Loglinear procedure reveals that only a model combining the two main effects of the independent variables with the effect of the three-level dependent variable fits the data

Table 1. Type of hypothesis in the third exercise (expected frequencies in parentheses)

	Majority		Minority	
	One	Several	One	Several
Same hypothesis	18 (8.8)	4 (6.9)	9 (9.0)	2 (8.2)
Reformulation	13 (9.8)	17 (7.8)	6 (10.1)	1 (9.3)
New hypothesis	7 (19.4)	9 (15.3)	24 (19.9)	33 (18.4)

($\chi^2(2) = 3.322, p = .190$; $G^2(2) = 3.559, p = .165$, see Table 1). Analyses of the effects specify that rewriting the same hypothesis is particularly frequent when the representation of a unique solution was induced ($z = 2.31, p < .02$); that reformulation of the source's hypothesis appears more when the hypothesis was proposed by a majority than when it was a minority's proposal ($z = 3.41, p < .001$) and that more participants proposed a completely new hypothesis when confronted with a minority ($z = 5.41, p < .001$) as well as when the representation of the task allowed several solutions ($z = 2.93, p < .002$).

Table 2 shows the frequency of confirmation and disconfirmation. The nature of the source has an effect ($\chi^2(1) = 22.161, p < .001$) as well as the representation of the task ($\chi^2(1) = 22.292, p < .001$). The minority source joined to the expectation of several possible solutions induces the highest rate of disconfirmation, higher than in the majority/several condition ($\chi^2(1) = 24.144, p < .001$) or than in the minority/one condition ($\chi^2(1) = 25.213, p < .001$). No other pertinent difference is significant.

Representation of the task

Four post-experimental questions show differences in the representations activated during the experimental session (cf. Table 3). As for the question 'Is it important to follow one single idea all the way?' (7 = important), a main effect of the source appears ($F(1,151)$

Table 2. Frequencies of confirmation and disconfirmation in the third exercise (expected frequencies in parentheses)

	Majority		Minority	
	One	Several	One	Several
Confirmation	37 (29.5)	28 (23.3)	35 (30.3)	11 (27.9)
Disconfirmation	1 (8.5)	2 (6.7)	4 (8.7)	25 (8.1)

Table 3. Mean answers in the post-experimental questions (standard deviations in parentheses)

	Majority		Minority	
	One	Several	One	Several
Is it important to follow one single idea all the way?	$6{,}48_a$ (1.13)	4.11_b (1.86)	3.86_{bc} (1.67)	3.03_c (1.62)
Do you consider it is useful to propose for the poll a series of cities compatible with your criterion?	6.45_a (1.19)	3.51_{bc} (2.01)	3.85_b (1.78)	2.92_c (1.61)
Is it important to be open to every possible solution?	2.74_a (1.68)	4.34_b (1.78)	4.76_b (1.70)	6.76_c (0.50)
Do you consider it is useful to propose for the poll a series of cities incompatible with your criterion?	2.81_a (1.49)	3.89_b (1.95)	3.83_b (1.69)	6.62_c (0.76)

Note. For each question, means having the same subscripts are not significantly different at $p < .05$.

$= 62.308, p < .001$), as well as that of the representation of the task ($F(1,151) = 34.882$, $p < .001$). Moreover, interaction between the two variables ($F(1,151 = 11.264, p < .001$) specifies that the majority/one condition is the one in which participants are by far the most convinced that it is important, more so than those in the majority/several condition ($t(151) = 6.541, p < .001$) or in the minority/one condition ($t(151) = 8.064, p < .001$). The minority/several condition induces the least agreement, less than in the majority/several condition ($t(151) = 1.833, p < .004$) and marginally less than in the minority/one condition ($t(151) = 1.883, p < .07$).

When subjects are asked if they find confirmation useful, a result pattern similar to that of the above item appears. A significant main effect is induced by the nature of the source ($F(1,151) = 39.229, p < .001$) and by the representation of the task ($F(1,151 = 52.075$, $p < .001$). The interaction is also significant ($F(1,151) = 14.068, p < .001$) and indicates that participants who used confirmation the most (in the majority/one condition) are by far the most convinced of its usefulness, more than those in the majority/several condition ($t(151) = 7.743, p < .001$) and more than those in the minority/one condition ($t(151) = 7.140, p < .001$). Participants who used confirmation the least (in the minority/several condition) are the least convinced of it usefulness, significantly less than those in the minority/one condition ($t(151) = 2.486$, $p < .014$), but not less than those in the majority/several condition ($t(151) = 1.523, p < .13$).

The question 'Is it important to be open to every possible solution?' leads to results in a reversed pattern compared to those of the two previous items. The two main effects (source: $F(1,151) = 80.928, p < .001$; task: $F(1,151) = 54.086, p < .001$) show that on one side participants in the minority/several condition agree the most, more than those in the minority/one condition ($t(151) = 5.792, p < .001$) or than those in the majority/several condition ($t(151) = 6.721$, $p < .001$). On the other side participants in the majority/one condition agree the least, less than those in the majority/several condition ($t(151) = 4.603, p < .001$) or than those in the minority/one condition ($t(151) = 6.034$, $p < .001$).

When subjects are asked if they find disconfirmation useful, the results show two main effects (source: $F(1,151) = 54.445$, $p < .001$; task: $F(1,151) = 61.921$, $p < .001$). Interaction between the two variables ($F(1,151) = 12.085, p < .001$) specifies that those who used disconfirmation the most (in the minority/several condition) are the ones who consider it by far the most useful, more than those in the minority/one condition ($t(151) = 8.037, p < .001$) or than those in the majority/several condition ($t(151) = 7.572$, $p <.001$). Participants in the majority/one condition are the least convinced that disconfirmation can be useful, less than those in the majority/several condition ($t(151) = 3.069$, $p < .003$) or than those in the minority/one condition ($t(151) = 3.031, p < .003$).

Discussion

This experiment shows that confirmation and disconfirmation appear within very coherent systems of correspondence between specific sources of influences and specific representations of the task. Confirmation matches the dynamics characteristic of participants exposed to the influence of a majority source when the task calls for a single correct answer; in this case nearly all used a confirmatory strategy. Let us then analyse what other dynamics appear to be characteristic of this condition. When asked to choose between the source's hypothesis and an alternative hypothesis (in the first two exercises), participants of this condition adopted the source's hypothesis, although the general tendency (also characteristic of the previous studies) is to differentiate oneself from the source at least once, probably because, in a task where aptitudes are at stake (a problem-solving one), competence necessitates a certain degree of autonomy (Lemaine, 1974). When asked to formulate a hypothesis by themselves, as was the case in the third exercise, participants confronted with a majority overall convergence towards the source's hypothesis, as they reformulate it more than the other participants. But when they are told that only one solution is possible, they adopt the source's hypothesis without any alteration more than those in the other conditions. It then appears that when the majority operates in a situation where one single solution is expected, participants imitate the source's hypothesis. The confirmation of the participants' hypothesis then becomes the confirmation of the source's hypothesis: participants thereby protect the costly (as the preference is for autonomy) consensus reached with the majority. In fact, results show that in this condition, and throughout the three exercises, participants use almost only confirmation, a strategy that *a priori* does not imply doubts concerning the validity of the hypothesis. This purpose appears in the fact that those exposed to the influence of a majority source when the task calls for a single correct answer recognize more than all the others that it is useful to propose an example compatible with the hypothesis under test. Thus, it is not surprising that these subjects are the least open to every possible solution and most convinced of the importance of following one single idea all the way.

Disconfirmation appears in the highest proportions when problem solving was submitted to participants confronted with a minority and convinced that several solutions were possible. Let us note that in this condition disconfirmation is no longer an exceptional behaviour: the usual 'bias' is reversed, as disconfirmation appears in higher proportions than confirmation. As for the choice of the hypothesis in the first two exercises, these participants are the ones who chose the highest proportion of the alternative hypothesis.

It is also in this condition that, in the open-ended exercise, they formulated the highest rate of hypotheses that do not share any element with that of the source. Thus, in this condition participants appear to be most open to the search for possible alternative solutions. Therefore, disconfirmation becomes a possible strategy, as they can consider alternatives; moreover, it appears to be a useful strategy (as recognized by these same participants) because it intervenes in a whole set of socio-cognitive mechanisms oriented towards the evaluation of the validity of multiple solutions. Finally, confirmation and disconfirmation appear to be characteristic of specific social situations.

As for the mechanisms of majority and minority influence, this experiment gives a certain support to the hypotheses concerning the effects of the relationship between the nature of the source and the representations of the task. It also shows a series of qualitative differences in the socio-cognitive processes underlying majority and minority influence.[4]

Majority induces convergent thinking and focuses hypothesis elaboration on its proposal. Representation of the task in terms of unity induces a similar effect, as participants focus more on the source's model. These processes are more pronounced when the majority nature of the source matches the correspondent representation of the task, in which case informational dependency to the majority produces a substantial amount of imitation. This necessity for consensus renders the search for alternative hypotheses not only useless (Kruglanski, 1990) but also dangerous, as the focus on a single hypothesis necessitates its validity and therefore calls for a testing strategy that does not contradict it: confirmation. The effects attributed to majority influence in problem solving would be mediated by a representation of the task in terms of unity and would be less pronounced when pluricity is allowed.

When the proposal of a problem-solving model comes from a minority, very few people adopt its proposal and, when possible, they formulate more new hypotheses; the same happens when a representation of the task in terms of pluricity is induced. This specifies that divergent thinking implies avoiding centring on a single judgement. This idea is supported by the fact that minority's effects are more pronounced in case of a correspondence with the representation of the task in terms of pluricity. It is in this case that the highest rate of disconfirmation is found, which shows that the possibility of considering alternatives is a fundamental factor for a problem-solving procedure to lead to validation, in the sense of a search for the validity and the limits of validity of the source's proposal as well as that of other possible alternatives.[5] In this context disconfirmation is likely to be used as it is no longer a means of invalidation, but a way to integrate the alternatives. These dynamics explain how minorities can lead to socio-cognitive constructivism and counterbalance the paralysing effects of groupthink (cf. Janis, 1972), social loafing (cf. Latané, Williams & Harkin, 1979) or more generally the existence of a too-dominant way of thinking (Moscovici, 1993).

[4] For a review of the debate about single vs. dual process in majority and minority influence, see Kruglanski & Mackie, 1990.

[5] In a study on the conflict relation between participants and a low status source, it was proposed that these constructivist effects can also be due to a conflict between incompetences: that of the participant (who is uncertain facing a problem-solving task) and that of the source (because of its low credibility). It has been argued that this conflict leads to validation and to the use of disconfirmation in hypothesis testing (Butera & Mugny, 1995).

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