UNIVERSIDADE DE LISBOA
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SHEEPS AND LONE WOLVES:
SOCIAL INFLUENCE IN REASONING TASKS

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Dissertação orientada pelo Professor/Investigador Doutor Mário Ferreira e pela Investigadora Doutora Joana Reis

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Abstract

Research in in judgment and decision making has typically treated the individual as an "isolated information processor" (i.e., thought and action are modeled as products of the cognitive operations of the individual thinker, rather than as an outcome of the social environments in which the individual is ingrained). However, people usually make their decisions in social settings (i.e., in the presence of others and having access to others' responses), rendering judgments and decision making as fundamentally social. Therefore, there is a need to broadened research, so as to take into consideration the impact of social influence on decision making processes. This thesis addresses this issue by combining a classic paradigm of the social influence field – Asch paradigm (Asch, 1956) – with classic reasoning tasks often used in judgement under uncertainty research – base-rate problems – in the same experiment. Participants were asked to solve a series of base-rate problems, alone (pre-test phase and post-test phase) and in group with five other alleged participants (experimental phase). In the experimental phase, the pattern of others' answers was manipulated. It could be a fully intuitive majority; a fully deliberate majority; a deliberate majority with an intuitive dissident; or an intuitive majority with a deliberate dissident. Results showed that intuitive participants seemed more susceptible to social influence than deliberate participants. This trend was in line with our expectations. In particular, they showed a marginal tendency to give less intuitive answers when faced with a fully deliberate majority than when faced with a deliberate majority with an intuitive dissident (i.e., ally). These initial results suggest that others' judgements may indeed alter to a certain extent the way we solve reasoning problems. Limitations and follow up studies are discussed.

Keywords: social influence, judgment and decision making, base-rate problems, conformism, heuristics, Asch paradigm

Resumo Alargado

De entre as diversas abordagens que se dedicaram ao estudo de julgamento e tomada de decisão, a mais proeminente será talvez a investigação em heurísticas e vieses de Tversky e Kahneman (Tversky & Kahneman, 1974; Kahneman et al., 1982; Gilovich et al., 2002), segundo a qual os nossos julgamentos e decisões são o produto de atalhos cognitivos (heurísticas) que nos permitem transformar tarefas complexas em julgamentos simples.

Mais recentemente, este programa tem dado lugar às teorias de processamento dualistas (Evans 2003, 2007; Evans & Curtis-Holmes, 2005; Evans & Stanovich, 2013; Frankish, 2010; Kahneman 2011, Kahneman & Frederick, 2002; Reyna, 2004; Sunstein, 2002) que propõem que temos dois sistemas de raciocínio distintos – Sistema 1 e Sistema 2 –, cada um recorrendo a tipos de processos diferentes – Tipo 1 (T1) e Tipo 2 (T2), respetivamente. Processos T1 são vistos como mais heurísticos e intuitivos, enquanto os processos T2 são vistos como mais analíticos e refletivos.

Embora investigação neste ramo tenha feito grandes contributos para o aprofundamento do nosso conhecimento acerca do julgamento humano, esta tem tratado o processo de tomada de decisão como altamente individual, feito num relativo isolamento social (Larrick, 2016). Pelo contrário, a maioria das decisões que tomamos são feitas em contextos sociais e organizacionais, onde nos sentimos pessoalmente responsáveis pelas nossas escolhas (Plous, 1993; Tetlock, 1985). Assim, torna-se necessário tomar em consideração o impacto que estes contextos sociais e organizacionais podem ter, aquando o estudo da tomada de decisão e julgamentos (Larrick, 2016; Plous, 1993; Strough et al., 2011; Tetlock, 1985), assim como os fenómenos de influência social decorrentes de fazer julgamentos na presença de outros e tendo acesso às respostas dos outros.

A presente dissertação tem como objetivo ajudar a esclarecer este problema, juntando, no mesmo contexto experimental, um paradigma clássico da investigação em influência social – paradigma de Asch (Asch, 1956) – e problemas de raciocínio tipicamente utilizados na investigação em julgamento e tomada de decisão – problemas de *base-rate* – com o propósito de explorar como é que os julgamentos de outros podem influenciar a forma como resolvemos estes problemas de raciocínio.

Em primeiro lugar, Asch (1956) denotou que, embora o efeito da maioria tenha sido considerável, grande parte dos participantes resolveu a tarefa percetiva simples – comparação do comprimento de linhas – de forma independente da maioria (que escolhia ostensivamente a resposta errada). Embora não tenha sido elaborada nenhuma hipótese neste sentido, os resultados do presente estudo estão em linha com os resultados de Asch – i.e., participantes responderam, em larga parte, de forma independente da maioria.

Ainda assim, nas suas experiências, Asch (1956) verificou que, quando confrontados com uma maioria opositora, apenas 25% dos participantes críticos resolviam a tarefa de comparação de linhas sem cometer qualquer erro. De facto, de acordo com o esperado, participantes intuitivos revelaram uma tendência para serem menos intuitivos quando face a uma maioria deliberada do que quando confrontados com uma maioria intuitiva, , embora as análises não tenham sido significativas.

Ao introduzir um aliado do participante no seu paradigma, Asch (1951) observou que, ao quebrar o consenso da maioria, este aliado (independentemente de resolver a tarefa corretamente ou não) foi capaz de reduzir drasticamente o conformismo, quase nulificando o efeito da maioria. Em linha com este efeito do aliado, observou-se que, no presente estudo, participantes intuitivos ofereceram respostas mais intuitivas quando face a uma maioria

deliberada e um dissidente intuitivo do que quando face apenas a uma maioria deliberada embora a diferença seja apenas marginalmente significativa.

Moscovici, por outro lado, observou que uma minoria era capaz de produzir influência social latente, defendendo que o confronto com uma minoria opositora consistente desencadeia um processo de validação que tem como propósito entender a divergência da mesma, o que pode conduzir a uma aceitação privada do julgamento da minoria (Garcia-Marques, Ferreira & Garrido, 2012; Moscovici, 1980; Moscovici & Lage, 1976). No entanto, embora se tenha esperado que participantes intuitivos após confrontados com um dissidente deliberado e uma maioria intuitiva fossem menos intuitivos do que após confrontados com uma maioria intuitiva, esta hipótese não se confirmou.

Apesar de os efeitos encontrados terem surgido apenas entre os participantes intuitivos, isto vai também de acordo com o esperado, visto que investigação passada sugere que os participantes deliberados possuem uma vantagem metacognitiva (Mata et al., 2013) – i.e., têm noção de que há um *output* intuitivo mas errado, que é contudo difícil de inibir e, portanto, uma resposta comum entre a maioria dos (outros) participantes – e, como tal, os efeitos de influência social (de uma maioria intuitiva) nestes participantes deliberados devem ser atenuados, ou até nulos.

Os resultados serão discutidos à luz das teorias dominantes em influência social. Serão ainda discutidas as implicações dos presentes resultados, bem como as principais limitações do presente estudo e propostas de estudos futuros para ultrapassar estas limitações.

Palavras-chave: influência social, julgamento e tomada de decisão, problemas de *base-rate*, conformismo, heurísticas, paradigma de Asch

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Introduction

In our daily lives, there is a plethora of judgments and decisions we must make and, although most decisions may only concern us, we do not make them in social isolation. On the contrary, we often have access to, or even seek, others' opinions and advice in order to make better or more informed decisions. Even though there is much research that seeks to explore the psychological mechanisms underlying decision making and social influence, there is a stark lack of research that seeks to explore and explain the way in which social influence processes can shape the way we make judgements and decisions.

Most research concerned with collective problem solving focuses on issues like whether individuals or groups are more biased, what types of processes do groups engage in when problem solving and on shared cognition (for more comprehensive readings on group decision-making see Hogg & Tindale, 2001; Kerr et al., 1996; Kerr & Tindale, 2004; Sniezek, 1992 and Tindale & Winget, 2019). These studies have shown that, when solving base-rate problems, group judgements tend to rely more on the individuating information than on the base-rate and are more extreme than those made by individuals (Argote et al., 1986) and that groups are more likely to commit the conjunction fallacy than individuals (Tindale et al., 1990). A somewhat different issue is to know how others' judgments may influence one's own judgment under uncertainty.

This thesis aims to shed some light into this issue, by combining in the same experimental setting a classic paradigm of the social influence field – Asch paradigm (Asch, 1956) – with classic reasoning tasks often used in judgement under uncertainty research – base-rate problems – with the purpose of showing the impact that the majority and minority of other peoples' judgements have in the way critical participants solve such problems.

With the present work we sought at furthering our knowledge of both fields (social influence and judgment and decision making) by building bridges to link them together.

In what follows, we will firstly begin with a brief review of the research made in the judgment and decision-making field – from the early heuristics and biases research program to the dual process theories of reasoning – to argue that this research has neglected to a certain extent the way social decision environments may shape people's reasoning processes and individual judgments.

Inspired by some of the main findings of the social influence research, we will then a) derive the hypotheses of the present Study; and b) test these hypotheses using an adaptation of Solomon Asch's experimental paradigm to the judgment under uncertainty domain.

Heuristics and biases research

Perhaps the most impactful proposal to have come out of the early research on judgement and decision-making (JDM) is Tversky and Kahneman's heuristics and biases research program (Tversky & Kahneman, 1974; Kahneman et al., 1982; Gilovich et al., 2002) in which they argue that – contrary to normative rational models – people's judgements and decisions are a product of cognitive shortcuts, labeled heuristics, that allow us to reduce usually complex tasks into much simpler judgements. However, despite their usefulness, heuristics may also, in certain circumstances, lead to severe biases and systematic errors that are not random and can, in fact, be described and even predicted.

Initially, the heuristics and bias approach focuses on three specific general-purpose heuristics that people use to estimate probabilities, frequencies, and other uncertain quantities: the representativeness, availability, and anchoring and adjustment heuristics.

The representativeness heuristic consists of determining the probability of a sample case by simply comparing it to its prototype (Kahneman & Tversky, 1973, see also, Kahneman et al., 1982; Raue & Scholl 2018; Sunstein 2002; Tversky & Kahneman 1974). The more similar the sample case is to its prototype – the more representative of its prototype the case sample is – the more likely it will seem, regardless of its actual probability of occurrence. For example, if I were to introduce you to my neighbor Lucas and tell you he is very tall, athletic, good with his hands and enjoys going to the gym in his free time, you might think that it is more likely for him to be a basketball player than, say, a cashier (even though there are much more cashiers in Portugal than basketball players). This bias has been wildly illustrated through the classic lawyer-engineer problem, in which people typically order different professions by probability and similarity in the exact same way (e.g., Ginossar & Trope, 1987; Kahneman & Tversky, 1973). The ecological validity of the representativeness heuristic relies on the covariance between similarity and probability; on the other hand, when the two do not covary, judgments by representativeness are bound to lead to characteristic and systematic biases.

The availability heuristic is used when people estimate the probability of an outcome by the ease with which other examples can be brought to mind. The easier it is to imagine or recall a certain event, the higher its perceived probability will be. For instance, if you were asked how many words, on a novel, end in "ing," you may be inclined to estimate a larger number than when asked how many words have a "n" as their second-to-last letter, as it is easier to recall words in the first scenario than in the latter (even though the number of words in the first scenario are necessarily a subset of the second) (Sunstein, 2002). This heuristic has some ecological validity, since instances of frequent outcomes are usually more accessible in memory, that is, recalled better and faster than those of less frequent ones. Nonetheless, it can lead to a number of biases (as in the abovementioned example), since the availability of an outcome is affected by many factors other than its frequency, like 1) the familiarity and salience

of the instances we are trying to recover; 2) the search sets adjacent to the retrieving task and; 3) the difficulty in imagining certain situations.

When using the anchoring-and-adjustment heuristic people make estimates by starting with an initial value that is then adjusted – this initial value or anchor can be suggested by the problem itself or arise as a result of a partial computation. However, since the adjustments are usually insufficient, different starting points yield different estimates, making the final judgments biased toward the initial value (anchor). To exemplify, when Tversky and Kahneman (1974) asked participants to guess the percentage of African countries in the United Nations, they made estimates that were biased towards a random value they had previously been exposed to via a wheel of fortune – even though this value was irrelevant to the judgment at hand (Tversky & Kahneman 1974).

Dual-process theories of reasoning

More recently, the heuristics and bias research program has given rise to the dual-process theories of reasoning, which have garnered increasing attention and popularity (Evans 2003, 2007; Evans & Curtis-Holmes, 2005; Evans & Stanovich, 2013; Frankish, 2010; Kahneman 2011, Kahneman & Frederick, 2002; Reyna, 2004; Sunstein, 2002). Generally, these theories posit that we have two very distinct reasoning systems – System 1 and System 2 –, which host qualitatively different types of processes – Type 1 processes (T1) and Type 2 processes (T2), respectively. T1 processes are thought to be more intuitive or heuristic, usually described as being rapid, automatic, non-conscious and associative; while T2 processes are viewed as analytical or reflective, often described as being slow, rule-based, conscious and deductive. Most of these features attributed to T1 and T2 processing are correlational in nature and do not cluster together in an all-or-none way. The fundamental difference between these

two types of processing is their reliance on working memory – while T1 processes make minimal demands on working memory, being largely autonomous, T2 processes rely heavily on it, making them very effortful and with low processing capacity (Evans & Stanovich, 2013).

The different procedures employed by these contrasting systems may yield conflicting results, with conflict and competition between heuristic and analytical processes being a common feature of dual-process theories. However, how such conflict arises and is, thus, resolved, differs between theories (Evans, 2007, see also, Evans & Stanovich, 2013). Parallel-competitive theories, such as Sloman's theory (Sloman, 1996; 2002) and others (e.g., De Neys, 2012, 2013, Pennycook et al., 2015), state that both processing types run in parallel, which may or not result in a conflict. When the different systems offer conflicting responses, System 2 monitors the response generated by System 1; though sometimes it fails in its monitoring efforts leaving the intuitive response unchecked. On the other hand, according to the prevalent default-interventionist theories (Evans & Stanovich, 2013; Kahneman, 2011), there is a sequential activation of both processes. T1 processes quickly produce a first output to judgement problems as they arise, which will be given as an open answer if there is no intervention from T2 processes – a *default* response. If there is analytical intervention, however, the intuitive response (if incorrect) will be inhibited and substituted by (a more suitable) analytical response.

This leads to a metacognitive asymmetry between intuitive and deliberate thinkers. Specifically, deliberate thinkers are more aware of different available answers when resolving a problem and of how difficult it is to inhibit the default intuitive answer. As such, they are also more conscious of the fact that many people will probably fail to inhibit the intuitive response in favor of a deliberate one and, thus, solve problems in an intuitive manner. Furthermore, when T1 processes lead to incorrect answers, deliberate thinkers are also more confident in their responses – being more willing than intuitive thinkers to bet on them – and

are better at judging their own performance, as well as others' performance, in reasoning tasks (Mata et al., 2013)[1].

Although T2 processes are often assigned a monitoring and corrective role of T1 outputs, one should not establish a one-to-one relationship between the type of processing used when making a decision and the accuracy of the decision, as both T1 and T2 can produce accurate and inaccurate decisions. Nonetheless, in many reasoning tasks that present a conflict between T1 and T2 outputs, response accuracy and the type of processing employed are often correlated.

Base-rate problems (like the one discussed in the beginning – my neighbor Lucas) are a prime example of reasoning tasks where you can usually find such a correlation. The way the problem is elaborated immediately activates a very compelling T1, intuitive, response, based on the provided cues (i.e., the stereotypical description), that conflicts with the response generated by attending to the statistical cues (i.e., the base-rates). Even though the stereotypical description prompts a T1 response – Lucas is a basketball player –, a T2 response would be that it is more likely that Lucas is a cashier, since there are more cashiers than basketball players in Portugal (i.e., sampling rule). In these circumstances, people must be able to overcome the appealing (but probably wrong) intuitive answer by engaging in T2 processing to override and replace it with a more accurate, rule-based answer.

[1] This is not to say that the tendency to be intuitive or deliberative is a stable dispositional trait. Indeed, Mata et al. (2013) showed that participants who initially were classified as "intuitive" could become "deliberative" if they were helped to arrive at the deliberative, (correct) answer.

Neglect of social contexts in JDM research

There is little doubt that the research made thus far, in the JDM field, has contributed greatly to the theoretical and empirical advances made in our understanding of human thought, nevertheless, this should not lead us to turn a blind eye on its limitations. Namely, it has, for the most part, treated the decision-making process as a highly individual one, made in isolation from others (Larrick, 2016; for exceptions see Butera et al., 2005; Jassen et al., 2021; Legrenzi et al., 1991).

The prevalent view in JDM research is that of the individual as an "isolated information processor" – thought and action are modeled as products of the cognitive operations of the individual thinker, rather than as an outcome of the social environments in which the individual is ingrained. In fact, the individual is still mostly treated as an autonomous decision maker even in obvious social settings, such as negotiation (Larrick, 2016). However, most decisions we make are not, in fact, the product of isolated information processing, but of more or less intensive interactions among members of groups. In other words, people usually make their decisions in social and organizational settings, in which they feel personally accountable or responsible (Plous, 1993; Tetlock, 1985).

Everyday decisions are laced with uncertainty – if for nothing else, for the simple fact that we cannot foresee the future –, making very few decisions clear cut. When faced with uncertainty, people tend to rely on the judgements of others to make sense of the information they have (Larrick, 2016). Furthermore, people often use the judgements of others to form their own views (Soll & Larrick, 2009).

Given that, in most decision-making circumstances, multiple people participate, affect and are affected by others' thinking, most judgments and decision making are fundamentally social. As such, JDM research needs to be broadened, so as to take into consideration the impact

of social influence in social and organizational contexts (Larrick, 2016; Plous, 1993; Strough et al., 2011; Tetlock, 1985).

Social Influence

Social influence occurs when the actions of one are molded by the presence of others (Secord & Backman, 1964), whether this presence is real, imagined, merely assumed (Crutchfield, 1955) or anticipated (Allport, 1954).

According to Deutsch and Gerard (1955), it is important to distinguish between two different types of social influence: normative and informational. Normative influence typically occurs when the individual feels the pressure to conform to the expectations of others, either in anticipation of positive effects, such as feelings of solidarity; and/or out of fear of negative consequences, such as feelings of alienation or rejection.

Informational influence, on the other hand, arises when the individual feels compelled to accept others' perception of reality, usually out of uncertainty about his own judgements. Nevertheless, informational influence will likely not take place if the individual has reasons to doubt the correctness of others' judgements.

Summing up, normative influence will be especially effective in modeling our manifest actions and statements when group approval is relevant, while informational influence mostly affects our private beliefs and attitudes. In fact, though these two types of influence usually work together, it is possible to behaviorally conform to others' expectations without privately accepting their beliefs and judgements and vice-versa.

The interest in social influence can be traced back to Sherif's experiments (1935, as cited by Garcia-Marques, Ferreira & Garrido, 2012). Sherif made use of the autokinetic effect – in which a light in a pitch-black room appears to move – and asked participants in a dark

room to estimate the distance that the light had moved. The results showed that people tend to adjust or base their judgments on the judgements of others. These sets of results gave way to the idea of social somnambulism – that of a passive human, who imitates ingroup members (especially leaders) because he has learned to associate imitation with social rewards.

Solomon Asch, however, was a strong opponent of the human passiveness associated with social somnambulism. He opposed the notion that social groups could lead a person to change their convictions in whichever way they desire and argued that there were various forms of social influence, aside from this "slavish submission to group pressure" (Asch, 1956). As such, Asch sought to prove that social influence was, rather, mediated by the active role that we have on the construction of our social realities. For this purpose, Asch developed a paradigm in which participants were inserted in groups with 7 to 9 confederates, who were previously trained on how they should behave throughout the experiment (unbeknownst to the participants, who thought the confederates were real participants). The task involved several trials in which participants were asked to perform a simple line comparison – participants were shown a board with a line on the right side and three others on the left side and had to state which line from the left side was the same size as the one on the right side. The participant would always be seated before the last confederate and each member of the group would state their answer aloud, in a fixed order. To the surprise of the participant, confederates would continuously answer the problem incorrectly (except for certain neutral trials). The incorrect answers were initially only moderately wrong and would, as the experiment advanced, turn into extremely incorrect answers. The experiment was followed by an interview with each participant.

Asch observed that very few participants (only one-fourth) were able to complete the task free of error. Majority's judgements distorted one-third of the reported estimates, contrasting with errors of less than one percent under the control conditions (in which

participants answered the line comparison task alone). This suggests that participants' judgments were influence by those of the (incorrect) majority. In other words, individual behavior may vary due to group pressure.

Though the majority effect was considerable, Asch noted that most people still seemed to perform the task independently – the majority effect was not the strongest force at work under these circumstances. The author also noticed that participants' performances were highly consistent – those who were independent early on tended to stay independent, and similarly for those who followed the majority – with the greatest number of errors being found in early trials. In fact, participants who yielded to the majority later in the experiment tended to (proportionally) commit less errors than those who adopted a yielding stance from the beginning.

Through the answers given in the post-experiment interview, and the results obtained, Asch generated different profiles to categorize the types of reactions participants had in his study (Garcia-Marques, Ferreira & Garrido, 2012):

- Independent participants
    - Truly independent – participants who were able to withstand the loneliness of their position and keep faith in their perceptive experience despite the mass opposition.
    - Fake independents – participants who were heavily affected by doubt and were convinced the majority was right but remained independent, nonetheless, because they did not forget the obligation of responding in accordance with their perceptive experience.
- Yielding participants

- Yielding at a “perceptual” level – participants who yielded apparently unaware of the degree of yielding.
- Yielding at the judgement level – participants who lost their confidence due to the pressure from the majority and rapidly accepted their answer to be wrong and the majority’s answer to be right, for they worried for their own accuracy and felt they lost the right to express their inferior judgements.
- Yielding at the action level – participants who yielding to avoid appearing deficient or peculiar, but believing their judgements to be right and feeling very little doubt about them.

The different types of participants found in Asch’s experiments, suggest that normative and informational influence are both likely to be operating, as the participant feels that the issue he is faced with is one of fact where only one solution is correct and that both himself and the confederates are motivated to provide a correct judgement. This renders the confederates as a reliable source; actually, it is likely that the participant would trust the unanimous judgement of others if he were to solve the task with his eyes closed. However, since he is solving the task with his eyes open, the participant is presented with a conflict between two apparently trustworthy sources – others’ unanimous judgement and his own perceptual judgment. As participants become less confident in their own judgements, they become more vulnerable to informational influence. On the other hand, many participants also reported yielding to the majority because they felt intense social pressure and feared being rejected. This is especially the case, because in Asch’s experiments participants were face-to-face with their peers, making the fear of being avoided or ridiculed more salient and maybe even making participants feel socially obliged to conform, which made them particularly vulnerable to normative influence, as well (Deutsch & Gerard, 1955 but see also Crutchfield, 1955).

Following this, Asch made a series of variations to the original paradigm (Asch, 1956; Garcia-Marques, Ferreira & Garrido, 2012), finding that: a) the majority effect is not restricted to a particular sensory dimension (it was also observed when the task required comparing the brightness of two discs); b) when the participants do not have to share their answer aloud, they make remarkedly less errors and no one conforms to the majority when they make extremely incorrect judgements; c) even with longer series of trials, most first errors occurred during the first two critical trials and initial reactions set participants' direction for their subsequent actions; d) independence seems to increase with the increase of neutral trials, though this effect was weak; e) when the response alternatives are reduced to two, the level of errors was similar to that of the original experiment, but individuals only took completely independent or completely yielding stances; and f) even when participants were informed that their judgements would be measured with a ruler at the end, results resembled those of the original experiment.

In one variation of his experimental paradigm, Asch (1951) introduced two critical participants instead of only one, in order to study the effects of breaking the majority, and found that the number of wrong answers given was significantly reduced (about 12%); however, he was faced with the problem that oftentimes one of these participants would yield to the majority and the original paradigm would be restored. As such, Asch returned to the single critical participant, but made one of his seven confederates (the one answering in fourth place) an ally of the participant – he would consistently give the correct answer, standing against the majority. With this change, he observed that conformism radically decreased (from 33% to 5,5%), nearly nullifying the majority effect. Further exploring these results, Asch found that the majority effect could also be reduced even if the ally gave wrong answers, as long as they were not in agreement with the majority, realizing that merely breaking the unanimous majority is a decisive factor in how conformism is manifested. Another set of variations revealed that if the ally eventually yielded to the majority, the majority effect would be immediately restored and

conformism levels would be even higher than in the original paradigm; when the opposite happens and the ally rebels against the majority mid-way through, conformism is quickly reduced. Finally, Asch observed that the majority effect would not be restored if instead of eventually yielding, the ally left half-way through the experiment under a plausible excuse, concluding that breaking the unanimous majority is only effective if the ally – responsible for the initial divergence – does not "betray" the critical participant and stays consistent in his rebellion (Garcia-Marques, Ferreira & Garrido, 2012).

Nonetheless, social influence cannot be reduced only to conformism to a majority, it also encompasses innovation – change observed in a majority due to a consistent minority –, as Moscovici continuously defended (Garcia-Marques, Ferreira & Garrido, 2012). Both minorities and majorities exert influence, however, they differ on their weight and on whether they modify our public behaviors or our private beliefs. Moscovici (1980; Moscovici & Lage, 1976) stated that conformism creates pressure to accept a message publicly, but not privately – compliance behavior –, while, on the contrary, innovation exerts influence to create a private, but not public, acceptance of a certain message – conversion behavior.

The influence that majorities and minorities have on others can also be understood in terms of the notion of conflict: no matter the origin, most influence attempts create some kind of conflict. This conflict can be due to the fact that the attempt introduces an inconsistency between public behaviors and private beliefs (on the part of individuals or groups) – dissonance – or because the source of influence has stances completely different from our own, in regard to something we consider important – divergence. When faced with a conflict situation, two concerns arise for the individual or group: a) the concern to appear consistent and socially acceptable to others and the self; and b) the concern to make sense of the confusing, social and physical, environment one is in. The center of the conflict, its direction, will vary depending on whether the influence source is a majority or minority (Moscovici, 1980).

According to Moscovici (1980; Garcia-Marques, Ferreira & Garrido, 2012), an individual facing a majority that is giving an opinion contrary to his own will be led to question why his opinion is divergent from the majority's. This question will be answered by engaging in a comparison process, in order to possibly detect a flaw in the alternative judgement or to understand why he made a mistake. Importantly, even if he fails to find a satisfactory explanation, he'll feel urged to make concessions. That is, to correct his response in order to be accepted by the majority. This will focus his attention on what others say, so as to fit in, even if, privately, he still maintains his reservations. As a result, his actions change during social interaction, but when this is over and the pressure of the majority is no longer felt, he will still come to the same opinion as he did initially.

On the other hand, when the source providing an opposing opinion to his own is a minority, it will be considered deviant from the get-go and require further verification. The individual will wonder how the minority came up with that opinion and, if the minority is insistent, undertake a validation process which implies the examination of the relation between the minority's response and the object of judgement (simultaneously scrutinizing his own response and judgements) in order to validate them. Contrary to the comparison process, the validation process will lead the individual to produce a different opinion than he initially did (without necessarily being aware of it) once he finds himself alone again – since his main concern during social interaction was to understand the minority opinion. As such, the judgement of a minority is likely to induce a stabler and more progressive change, than that of a majority (Garcia-Marques, Ferreira & Garrido, 2012; Moscovici, 1980).

In summary, when faced with a discrepant majority, one focuses all attention on others – the conflict is between responses –, while when faced with a discrepant minority, all attention is directed towards reality – the conflict is between perceptions of the reality (Garcia-Marques, Ferreira & Garrido, 2012; Moscovici, 1980).

Willis and Levine (1976), on the other hand, analyze social influence in terms of the task that the individual is faced with. They proposed a way to distinguish tasks into different categories, dividing them into tasks that are 1) verifiable at present, 2) verifiable in principle and 3) unverifiable in principle. Tasks that are verifiable at present are those in which the individual believes he has all the necessary abilities to correctly reach the correct answer, according to some universally shared criterion. Because the individual holds this belief, these tasks are not particularly susceptible to informational social influence, as he will always assume the wider social consensus is in accordance with his judgment, even if he is faced with disagreeing individuals.

On verifiable in principle tasks, individuals might not know the "true" answer, but they believe such an answer exists, according to some universally shared criterion. Therefore, this class of tasks is most susceptible to social influence, so long as the individual perceives the source a minimal level of expertise that exceeds his own. These are the most relevant for the present study, because participants are likely to understand base-rate problems as a task in which there is a correct answer, but not be overly confident in their answers.

Finally, unverifiable in principle tasks are mostly immune to social influence, since there isn't a single correct answer and individuals are free to answer as they please – their answer is as good as any other opposing one.

In the same vein of Willis and Levine's analysis, the Conflict Elaboration Theory of Social Influence (CET) proposed by Mugny and colleagues (1995), also places great importance on the task the individual is performing – i.e., whether it allows for only one correct response (the others being wrong) or if a correct response cannot be identified and whether the response to the task has relevant social implications and can socially anchor the targets or if it lacks such social implications. However, this proposal does not forego the importance of the

concept of conflict, defending that the basic explanatory notion underneath social influence process is conflict elaboration. Since any influence attempt is bound to introduce some kind of conflict between the individual and a relevant other (Moscovici, 1980; Mugny et al., 1995), conflict elaboration refers to the meaning given to this divergence, and it will depend on 1) the type of task and 2) the type of source of influence the individual is faced with. This means that different sources and tasks may produce distinct conflict elaboration, and different ways of elaborating the conflict lead to different patterns of influence – manifest or latent.

Combining the two aforementioned factors (relevance of error and relevance of social implications) Mugny et al. (1995) also proposed a way of distinguishing between different types of tasks, dividing them into four types: objective and unambiguous tasks (TONA), aptitude tasks (TAP), opinion tasks (TOP) and non-implicating tasks (TANI) (Table 1).

Table 1

Summary of the characteristics of each type of task (Mugny et al., 1995)

Type of task	Example	Relevance of error	Relevance of social implications	Type of conflict introduced	Expected social conflict effect
TONA	Asch's line comparison task	It allows for one correct answer	Socially implicating	Socio-epistemic conflict	Majority source will lead to compliance, while a minority source might lead to innovation
TAP	Problem-solving tasks	It allows for one correct answer	Socially implicating	Conflict of competences	Competent source will exert informational influence, while a low-competence source may induce latent influence
TOP	Choosing a political party	It allows for a wide variety of positions	Socially anchoring	Relevant ingroup source will introduce a normative conflict	Relevant ingroup will lead to conformism, while an outgroup source can lead to latent change
TANI	Choosing which color phone to buy	It allows for a wide variety of positions	Not telling of a specific social membership or ranking	Differing views of others will not introduce a conflict	Social influence effects are not expected to take place

Note. For more information regarding TOP and TANI tasks refer to Appendix A.

Here, I will only be referencing TONA and TAP tasks, as they are the ones with implications for the present study. Similarly to tasks verifiable in present, in TONA tasks like the line comparison task used by Asch (1956), individuals know that there is a correct answer and what that answer is; as such, they expect to find unanimity in the answers given by a group. Therefore, anyone who breaks that unanimity expectation will introduce a socio-epistemic conflict, which is understood as a relational one if the source is a majority. This conflict elaboration activates a fear of disapproval or rejection (Levine, 1989, as cited by Mugny et al., 1995) that is resolved through compliance. A minority source, however, will not generate such a relational conflict, thus, this conflict may lead to innovation, as observed in Moscovici and Personnaz's (1986) experience with the blue/green paradigm (see also Moscovici, 1980).

In TAP tasks, like in tasks verifiable in principle, individuals might believe there is a correct or more valid answer, but they do not know what that answer is from the get-go. This is the case for base-rate problems – participants might feel the need to reach a consensus, but a lack of it will not fail any expectations. A desire to increase judgement correctness or to present one's best self-image will shape conflict elaboration, leading to informational dependence on a competent source (Deutsch & Gerard, 1955). Without any other cues regarding competency, this is likely to be how participants view likeminded individuals, perceiving dissident individuals as having low competence - intuitive participants view other intuitive participants as highly competent, while viewing deliberate participants as having low competency; the opposite being true for deliberate participants. However, a conflict with a low-competence source cannot be resolved by simply rejecting the opposing point of view, as that doesn't guarantee the validity of one's point of view. This conflict so called "conflict of incompetences" activates a validation process that leads the individual to consider more dimensions of the task, in a more creative way (Butera & Mugny, 1995; Mugny et al., 1995). Nonetheless, Butera and colleagues (1996) have shown that participants are more likely to

adopt a majority's position when they believe the task to only allow for one correct answer. As such, it may also be the case that, in TAP tasks, a majority source will seem more competent, regardless of whether it opposes the participant or not. Additionally, participants faced with an opposing source are more likely to accept its information if this source is a majority, than when it is a minority (Legrenzi et al., 1991).

The Present Study

Ergo, the present study intends to explore the impact a majority and minority (i.e., a dissident from the majority) may have on the way critical participants solve reasoning problems. Herein, we will be using base-rate problems, which are typically used in judgment in decision making research, as they have an intuitive response that immediately comes to mind (based on the stereotypical description) and a, more adequate, deliberate response (which takes into consideration the base-rates) – contrarily to Asch's line comparison task, where the intuitive response was correct. In this kind of problems, participants do not immediately know what the correct answer is, but will likely believe there is a single correct or more appropriate answer (Willis & Levine, 1976). Participants might not expect unanimity in the group's answers, but they will be motivated to present their best image and maximize the correctness of their judgements. As such, participants will be vulnerable to both informational and normative influence.

In the same vein, and according to conflict elaboration theory, base-rate problems are TAP tasks. Individuals might believe there is a correct or more valid answer, but they do not know what that answer is from the get-go. They can also feel the need to reach a consensus, but a lack of it will not fail any expectations. Hence, a desire to increase judgement correctness or to present one's best self-image will shape conflict elaboration. In other words, conflict

experienced in base-rate problems has to do with competence. Here, conflict with a competent source is resolved through informational dependence (Deutsch & Gerard, 1955) – the competent source's point of view will be accepted as being more valid and, thus, adopted, resolving both uncertainty and social conflict. However, a conflict with a source that is perceived as having low-competence (even if the participant does not perceive himself as particularly competent) cannot be resolved by simply rejecting the source's point of view, as that doesn't guarantee the validity of one's point of view. Instead, this "conflict of incompetences" (between the participant and the source) activates a validation process that is expected to lead the individual to consider more dimensions of the task, in a more creative way – allowing for the discovery of novel and better solutions. In our case, less neglect and better integration of base-rate information in the responses to the problems.

When there is no previous information regarding others' competency, participants will likely infer it from the way they themselves solve the problems. As such, intuitive participants might consider an intuitive source as an equally competent one, while a deliberate source will initially appear to be of low-competence. In the latter case, if participants doubt their own competence (given the nature of the base-rates task), a validation process may be activated, as intuitive participants try to understand why the deliberate source's answer deviates from their expectation. On the contrary, deliberate participants will see the deliberate source as a competent one. However, because deliberate participants are more confident in their own answers and are often aware that many people may fail to inhibit the intuitive response (Mata et al., 2013), they are likely to perceive themselves as more competent than the intuitive source and thus they are not going to engage in a validation process - as they already "know" why an intuitive participant would answer has he does.

Therefore, we expect that:

1. Social influence effects should occur mostly for intuitive participants and be less pronounced (if occurring at all) for deliberate thinkers.

Following not only Asch's (1956) findings that a significant amount of people publicly adopts the majority's responses, but also the nature of the task used herein - i.e., in contrast to Asch's (TONA) task, base-rates problems are TAP tasks, with a correct answer that may not be verifiable in present but that is verifiable in principle (Mugny et al., 1995; Willis & Levine, 1976) – we expect that intuitive participants:

2. Faced with an intuitive majority, will give more intuitive responses on the experimental phase than when faced with a deliberate majority.

Given that in Asch's (1951) experiments, the presence of a likeminded individual was enough to remarkedly reduce conformism:

3. When faced with a deliberate majority that includes an (intuitive) dissident (i.e., an ally of the participants), intuitive participants will give more intuitive responses on the experimental phase than when faced with a consensual deliberate majority.

In light of Moscovici's (1976) proposal that a consistent minority can lead to innovation and change participant's judgments in a subsequent task and Mugny and colleagues' (1995) proposal that, in TAP tasks, a conflict with a low-competence source can activate a validation process, which leads to better integration of the base-rates, it can further be expected that:

4. When faced with an intuitive majority that includes a dissident (deliberate) confederate, intuitive participants will give more deliberate responses on the post-experimental phase than when faced with a consensual intuitive majority.

On the other hand, for deliberate participants, two hypotheses that mirror 2 and 3 for intuitive participants may be derived:

5. Faced with a deliberate majority, participants will give more deliberate responses on the experimental phase than when faced with an intuitive majority.
6. When faced with an intuitive majority that includes an (deliberate) dissident (i.e., an ally of the participants), participants will give more deliberate responses on the experimental phase than when faced solely with a consensual intuitive majority.

However, as aforementioned, the predicted effects for deliberate participants are expected to be greatly attenuated compared to the effects predicted for intuitive participants. Furthermore, since deliberate participants are more confident in the accuracy of their responses and more conscious of the fact that most people might answer intuitively (Mata et al., 2013), they should not engage in a validation process when faced with a divergent minority and, thus, innovation should not take place. Therefore, we do not expect mirrored results of hypothesis 4.

Method

Participants

One hundred and twenty-five students (M_{age} = 20, 1 identified as non-binary and 18 were male) were recruited in exchange for course credit. Participants who knew the base-rate problems beforehand and/or who did not consent to the use of their answers for analysis after debriefing were eliminated.

Materials

Fifteen base-rate problems adapted from Franssens and De Neys (2009) were selected out of a pool of pre-tested problems and divided into three different sets – three problems for the pre-test phase, nine problems for the experimental phase and the remaining three problems for the post-test phase. In the experimental phase, three out of the nine problems were transformed into non-conflict problems (i.e., the T1 generated answer matched the T2 generated answer). Following Asch's procedure, two of these problems were placed right at the beginning (1st and 2nd place), while the third one was placed after the first three conflict problems (6th place). In order to control for order effects, two lists of the original 15 problems were generated with distinct (randomized) presentation orders.

Design

Participants were randomly allocated to one of four conditions – i.e., fully intuitive majority (condition 1), fully deliberate majority (condition 2), deliberate majority with an intuitive dissident (condition 3) and intuitive majority with a deliberate dissident (condition 4).

Procedure

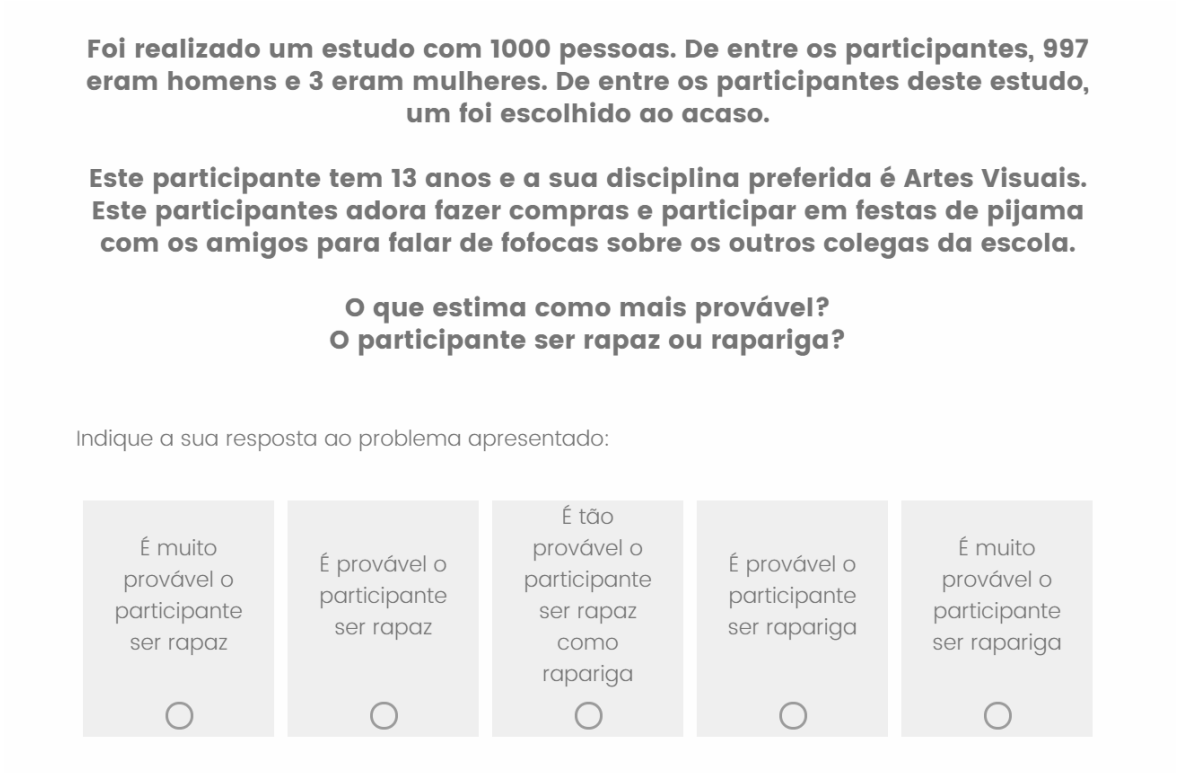
The present experiment was implemented online, via Qualtrics. Before starting the experiment, participants read the informed consent and agreed to it. The initial instructions explained that this study intended to explore how people make judgements under uncertainty in social contexts and adverted participants to the need of completing the experiment in a quiet environment and without distractions.

Participants were then told that they would integrate a group with five other participants, where they would need to solve different problems, in turn, and that they would be asked, at the end, to evaluate the others' performance. Before being allocated to a group, participants created a profile through which they could be introduced to the other participants in the group.

Following this, while allegedly waiting to be allocated into a group, participants started the pre-test phase, in which they solved the first three base-rate problems, by selecting, in a 5 point scale, whether they thought A or B was more likely, given the problem at hand (1 – *A is very likely*, 2 – *A is likely*, 3 – *A is as likely as B*, 4 – *B is likely*, 5 – *B is very likely*). The deliberate option was always placed at the left-end of the scale, while the intuitive option was placed at the right-end of the scale (Figure 1). Participants also indicated, in a 5-point scale, how confident they were in their answer (1 – *Not at all confident* to 5 – *Completely confident*).

Figure 1

Type of problem shown to participants



After the pre-test phase, participants were introduced to the other participants – their icon, age and gender was shown (Figure 2).

Figure 2

Confederates' profiles

Participants were then informed that they had been randomly assigned to solve the problems in last placed and asked to take careful notice of the others' responses. For each of the nine problems presented in this phase (the experimental phase), participants read the problem, saw the others' responses popping up on screen one by one and, finally, gave their own answers and indicated how confident they were in their answers. The others' answers differed according to the experimental condition participants were allocated to – i.e., fully intuitive majority, fully deliberate majority, deliberate majority with an intuitive dissident and intuitive majority with a deliberate dissident. Participants in the fully intuitive majority condition only saw extreme intuitive answers from the confederates (point 5 in the aforementioned scale); whereas participants in the fully deliberate majority condition only saw extreme deliberate answers from the confederates (point 1). On the other hand, participants in the deliberate majority with an intuitive dissident condition saw four extreme deliberate answers and one extreme intuitive answer from the confederates (the latter given by the alleged participant answering in third place); whereas participants in the intuitive majority with a deliberate dissident condition saw four extreme intuitive answers and one extreme deliberate answer. Regardless of the condition, in the non-conflict problems, the others always gave extreme dominant (correct) answers (supported by both T1 and T2 judgment processes).

After completing the experimental phase, participants started the post-test, in which they solved three additional problems, in the same way as the pre-test phase, without having access to others' responses. Participants' response times to the base-rate problems were measured in the three phases of the experiment.

Finally, participants evaluated the others' performance, on a 5-point scale that ranged from "Very bad" to "Very good" and rated how much they agreed with a set of sentences concerning their own performance, on another 5-point scale ranging from "Completely disagree" to "Completely agree" (i.e., "I avoided following others' responses", "I didn't want

to go against others' responses" and "I was very influenced by others' responses"), which were introduced as exploratory measures. They also answered a few questions regarding the condition under which they completed the experiment – if it was done on a computer, in a quiet environment and without interruptions.

Before leaving the experimental setting, participants were debriefed and asked, once more, for consent in using their data for this study.

Results

Pre-test Phase

Before starting the analysis, participants' response scale was inverted, so that answers lower than the mid-point of the scale (3) were intuitive, while answers higher than the mid-point were deliberate. Mean performance for the pre-test phase was calculated for each participant. A median split of participants' performance (Median = 2.67) was used to divide the sample in two groups: intuitive and deliberate. Participants with a mean performance lower than the median were classified as intuitive participants (N = 63) (i.e., in average these participants judge the stereotype-based response as more likely than the response according to extreme base-rates; M = 2.10, SE = 0.06). Participants with an average score equal or higher than median were classified as deliberate (N = 62) (i.e., these participants considered the base-rates response more likely or at least they show some sensitivity to the base-rates by responding in the mid-point of the scale; M = 4.05, SE = 0.09).

Exploratory Measures

Before moving on to the main analysis, exploratory measures were analyzed to see how participants reacted to the confederates. For this, participants' rating of confederates' performance and participants' agreement with a set of sentences concerning their own performance (i.e., "I avoided following others' responses", "I didn't want to go against others' responses" and "I was very influenced by others' responses") will be analyzed below. The deliberate majority with an intuitive dissident and intuitive majority with a deliberate dissident conditions will not included in the exploratory analysis reported below, as confederates' answers were not unanimous and, so, we do not know if participants responded to these measures considering the dissident performance, the majority performance or a mix of both.

When analyzing how participants rated confederates' performances, a between-subjects analysis of variance (ANOVA) with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority (C1) vs. fully deliberate majority (C2)) as factors, revealed no significant effects (see Table C1, Appendix C). However, intuitive participants' trend shows that they rated confederates' performance more positively when faced with a fully intuitive majority than when faced with a fully deliberate majority (M_{C1} = 3.33, SE_{C1} = 0.18 vs. M_{C2} = 3.19, SE_{C2} = 0.17).

When analyzing participants' reports on whether they agreed with the statement "I avoided following confederates' responses", a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority) as factors, revealed no significant effects (see Table C2, Appendix C). Tough there were no significant effects, intuitive participants' trend shows that they agreed more strongly with the statement when faced with a fully deliberate majority than when faced with a fully intuitive majority (M_{C2} = 3.88, SE_{C2} = 0.20 vs. M_{C1} = 3.65, SE_{C1} = 0.21).

When analyzing participants' reports on whether they agreed with the statement "I avoided going against confederates' responses", a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority) as factors, revealed no significant effects (see Table C3, Appendix C). Nonetheless, intuitive participants' trend shows that they disagreed more strongly with the statement when faced with a fully deliberate majority than when faced with a fully intuitive majority (M_{C2} = 1.75, SE_{C2} = 0.19 vs. M_{C1} = 2.07, SE_{C1} = 0.20); contrarily, deliberate participants disagreed more strongly with the statement when faced with a fully intuitive majority than when faced with a fully deliberate majority (M_{C1} = 1.71, SE_{C1} = 0.18 vs. M_{C2} = 2.04, SE_{C2} = 0.21).

When analyzing participants' reports on whether they agreed with the statement "I was influenced by confederates' responses", a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority) as factors, revealed a marginal main effect of baseline categorization, $F(1, 121) = 3.61$, $p = .060$, $\eta_p^2 = .03$, such that deliberate participants disagreed more strongly with the statement than intuitive participants ($M = 1.58$, $SE = 0.12$ vs. $M = 1.91$, $SE = 0.12$) (see Table C4, Appendix C). Additionally, intuitive participants' trend shows that they disagreed more strongly with the statement when faced with a fully deliberate majority than when faced with a fully intuitive majority ($M_{C2} = 1.72$, $SE_{C2} = 0.17$ vs. $M_{C1} = 2.10$, $SE_{C1} = 0.17$).

Taken together, these results suggest that participants were not indifferent to the answers given by confederates, given that their answers varied when faced with a fully intuitive majority and when faced with a fully deliberate majority.

Experimental Phase[2]

Performance. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority (C1) vs. fully deliberate majority (C2) vs. deliberate majority with an intuitive dissident (C3) vs. intuitive majority with a deliberate dissident (C4)) as factors, revealed a main effect of baseline categorization, $F(1, 117) = 120.28$, $p < .001$, $\eta_p^2 = .51$, such that intuitive participants gave more intuitive responses ($M = 2.37$, $SE = 0.10$) and deliberate participants gave more deliberate responses ($M = 3.89$, $SE = 0.10$) (Figure 3). No other results reached statistical significance (including the baseline categorization × participant condition

[2] For results regarding the non-conflict problems refer to Appendix B and Tables B1-B3.

interaction, $F(1, 117) = 1.91$, $p = .133$). However, to test our hypothesis that intuitive participants would be more intuitive when faced with a fully intuitive majority than when faced with a fully deliberate majority, a planned contrast between the fully intuitive and fully deliberate conditions for this type of participants was computed. This difference was clearly not significant, $t(117) = -0.89$, $p = .376$, even if intuitive participant's trend is in line with what was expected – they are slightly less intuitive when faced with a fully deliberate majority than when faced with a fully intuitive majority ($M_{C2} = 2.60$, $SE_{C2} = 0.19$ vs. $M_{C1} = 2.36$, $SE_{C1} = 0.19$).

To test the hypothesis that intuitive participants would be more intuitive when faced with a deliberate majority with an intuitive dissident than when faced with a fully deliberate majority, a planned contrast between these conditions was computed, revealing that intuitive participants were less intuitive when faced with a fully deliberate majority than when faced with a deliberate majority with an intuitive dissident ($M_{C2} = 2.60$, $SE_{C2} = 0.19$ vs. $M_{C3} = 2.09$, $SE_{C3} = 0.20$; $t(117) = 1.87$, $p = .064$). Although this difference is only marginally significant.

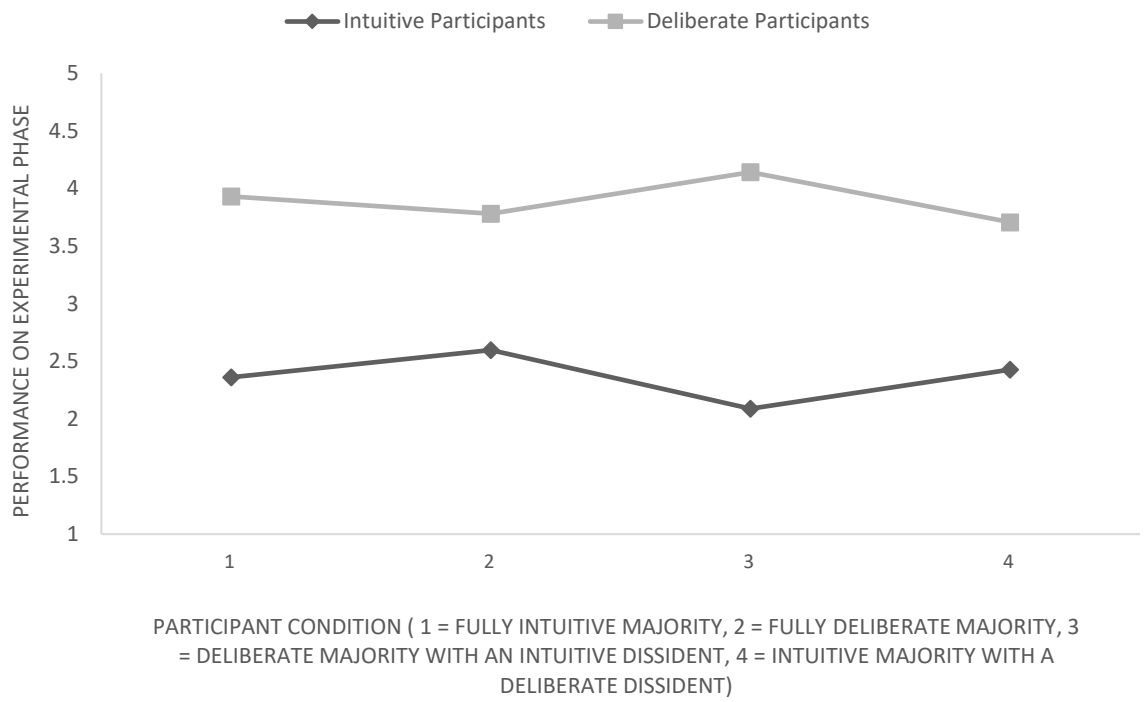
Another planned contrast was computed to test the hypothesis that deliberate participants would be less deliberate when faced with a fully intuitive majority than when faced with a fully deliberate majority, revealing no significant difference between deliberate participants' answers in these conditions, $t(117) = .52$, $p = .605$.

A final planned contrast was computed to test the hypothesis that deliberate participants would be less deliberate when faced with a fully intuitive majority than when faced with an intuitive majority with a deliberate dissident, revealing no significant difference between deliberate participants' answers in these conditions, $t(117) = .86$, $p = .393$ (refer to Table 2)[3].

[3] To confirm these findings, participants were divided in three groups using terciles. Intuitive participants (N=33), neutral participants (N=56) and deliberate participants (N=36). The same pattern of results was found – a main effect of baseline categorization, $F(1,113) = 60.40$, $p < .001$, $\eta_p^2 = .52$, and a marginally significant

Figure 3

Participants Performance on Experimental Phase



difference between intuitive participants answers when faced with a fully deliberate majority and when faced with a deliberate majority with an intuitive dissident, $t(113) = 1.85$ $p = .066$ (see Appendix D, as well as Figure D1 and Table D1).

Table 2

Planned contrasts results

Comparison	Estimate	SE	df	t	p
Intuitive participants					
Condition 1 vs Condition 2	-0.235	0.264	117	-0.889	0.376
Condition 2 vs Condition 3	0.509	0.273	117	1.868	0.064
Condition 1 vs Condition 4	-0.065	0.278	117	-0.234	0.816
Deliberate participants					
Condition 1 vs Condition 2	0.151	0.292	117	0.518	0.605
Condition 2 vs Condition 3	-0.36	0.296	117	-1.214	0.227
Condition 1 vs Condition 4	0.225	0.263	117	0.858	0.393

Response times. Response times (converted to $\log_{10}$) were analyzed in a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors. The ANOVA revealed a main effect of participant condition, $F(1, 117) = 2.84$, $p = .041$, $\eta_p^2 = .07$, such that participants took more time in the intuitive majority with a deliberate dissident condition ($M_{C4} = 0.96$, $SE_{C4} = 0.03$), followed by the deliberate majority with an intuitive dissident condition ($M_{C3} = 0.90$, $SE_{C3} = 0.04$), the fully intuitive majority condition ($M_{C1} = 0.87$, $SE_{C1} = 0.03$) and, finally, the fully deliberate majority condition ($M_{C2} = 0.83$, $SE_{C2} = 0.04$). This, again, shows that participants were not indifferent to confederates' responses, as they took longer to answer when confederates' responses were not unanimous – suggesting that they detected the conflict between confederates' responses.

Though baseline categorization × participant condition interaction was not significant, $F(1, 117) = 1.33$, $p = .268$, planned contrasts revealed a marginally significant difference

between deliberate participants' response times when faced with a fully intuitive majority and when faced with a fully deliberate majority, $t(117) = 1.84$, $p = .068$, such that deliberate participants took less time to solve the problem when faced with a fully deliberate majority than when faced with a fully intuitive majority ($M_{C2} = 0.76$, $SE_{C2} = 0.05$ vs. $M_{C1} = 0.89$, $SE_{C1} = 0.05$) (see Table E1, Appendix E).

Confidence. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects (see Table E2, Appendix E).

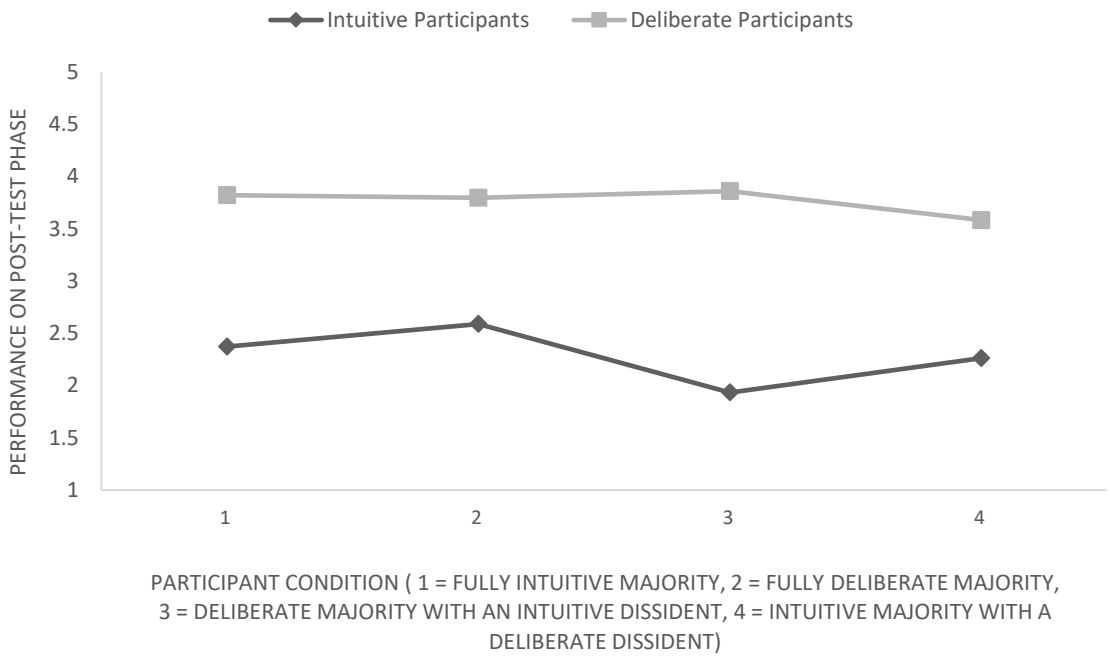
Post-test Phase

Performance. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed a main effect of baseline categorization, $F(1, 117) = 81.21$, $p < .001$, $\eta_p^2 = .41$, such that intuitive participants gave more intuitive responses ($M = 2.29$, $SE = 0.12$) and deliberate participants gave more deliberate responses ($M = 3.77$, $SD = 0.12$) (Figure 4). Although the baseline categorization × participant condition interaction was not significant, $F(1, 117) = .89$, $p = .449$, a planned contrast revealed a significant difference between intuitive participants' answers after being faced with a fully deliberate majority and after being faced with a deliberate majority with an intuitive dissident,

$t(117) = 2.04$, $p = .044$, such that intuitive participants tended to be less intuitive without the intuitive dissident ($M_{C2} = 2.59$, $SE_{C2} = 0.22$ vs. $M_{C3} = 1.93$, $SE_{C3} = 0.23$) (Table 3)[4].

Figure 4

Participants Performance on the Post-test Phase



[4] To confirm these findings, analysis were, again, computed using the participant division by terciles. Only a main effect of baseline categorization, $F(1,113) = 57.47$, $p < .001$, $\eta_p^2 = .50$, was found. The difference between intuitive participants' answers when faced with a fully deliberate majority and when faced with a deliberate majority with an intuitive dissident, $t(113) = 1.33$ $p = .186$, was not significant (see Appendix D, as well as Figure D2).

Table 3

Planned contrasts results

Comparison	Estimate	SE	df	t	p
Intuitive participants					
Condition 1 vs Condition 2	-0.215	0.311	117	-0.69	0.492
Condition 2 vs Condition 3	0.655	0.322	117	2.037	0.044
Condition 2 vs Condition 4	0.326	0.328	117	0.994	0.736
Condition 1 vs Condition 4	0.111	0.328	117	0.338	0.94
Deliberate participants					
Condition 1 vs Condition 2	0.026	0.344	117	0.075	0.857
Condition 2 vs Condition 3	-0.063	0.35	117	-0.181	0.444
Condition 1 vs Condition 4	0.238	0.31	117	0.769	0.322

Response times. Response times (converted to $\log_{10}$) were analyzed in a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors. The ANOVA revealed no significant effects (see Table F1, Appendix F).

Confidence. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects (see Table F2, Appendix F).

Discussion

In this thesis we sought to further our knowledge of the social influence and judgment and decision-making fields by building bridges that may link them together, through the exploration of how the judgments of a majority and minority affect the way critical participants solve reasoning problems, base-rate problems specifically.

Firstly, Asch (1956) found that, though the majority effect was considerable most people still seemed to perform the task independently – in other words, the majority effect was not the strongest force at work in Asch's paradigm. In the present experiment, participants also seemed to be largely independent, which suggests that, even in a reasoning domain (vs. perceptual domain), the given conditions stimuli – the facts that were being judge – were more decisive than the majority effect. Additionally, we found that participants were very consistent throughout the experience – intuitive participants remained intuitive and deliberate participants remained deliberate.

Asch (1956) found that, when faced with an opposing majority, only 25% of critical participants were able to solve the task without error. Conversely, we found that intuitive participants' trend showed they were less intuitive when faced with a fully deliberate majority (i.e., opposing majority) than when faced with a fully intuitive majority. This trend was found both when participants were divided by mean performance's median and when participants were divided by terciles. However, it was not statistically significant. Nonetheless, this might suggest that with a larger sample and better controlled experimental conditions (see limitations below) it may be possible to show that, in the absence of any cues regarding the source's competence, participants will assume the majority to be competent, even if it opposes their own judgement. This would be in line with findings that participants faced with an opposing source in inductive reasoning problems are more likely to accept its information if this source is a majority, than when it is a minority (Legrenzi et al., 1991), especially if they believe the task

to allow for only one correct answer (Butera et al., 1996). Additionally, this would mean that the presence of a majority source in a TAP task would produce similar effects to those of a high-competence source (Mugny et al., 1995).

Similar to Asch's (1951) findings showing that introducing a confederate (ally) who opposed the majority – breaking its consensus – significantly reduced conformism, we found that intuitive participants would be marginally less intuitive when faced with a fully deliberate majority than when faced with a deliberate majority with an intuitive dissident. Such a difference was found when participants were divided by mean performance's median, as well as when they were divided by terciles. This suggests that breaking majority's consensus might be crucial to reducing conformism not only in a perceptual domain, but also in the reasoning domain. Alternatively, it may be suggestive that, in line with what was proposed by Willis and Levine (1976), when faced with a non-consensual majority, the dissident confederate will encourage participants to assume themselves to be right according to some universally shared criterion and, as such, not feel pressure to yield to the deviant majority.

Furthermore, our hypothesis that intuitive participants would be less intuitive in a post-test phase after being faced with an intuitive majority with a deliberate dissident than after being faced with a fully intuitive majority was not supported by our results, contrasting with the idea that a validation process, which might lead to latent influence, is activated when an individual is faced with an opposing minority (Garcia-Marques, Ferreira & Garrido, 2012; Moscovici, 1980; Moscovici & Lage, 1976) or with a low-competence source (in this case, a dissident), in a TAP task (Mugny et al., 1995). However, in Butera et al. (1996)'s experiment, when participants were faced with a minority and believed the task to allow for several solutions, they engaged more in a validation process, considering more dimensions of the task, in a more creative way – allowing for the discovery of novel and better solutions. As such, it might be the case that we did not find any latent influence effects, because participants believed

the task to allow for only one correct response, which lead them to accept the majority's position rather than to try to understand the dissident's position.

Moreover, because deliberate participants are aware that there is a highly compelling intuitive solution to reasoning problems that is hard to inhibit and, as such, the *default* answer of most people (Mata et al, 2013), we expected little to no social influence effects in the case of deliberate participants (since most of them are likely to correctly guess that the opposing intuitive majority is wrong). Our findings seem to support this hypothesis. Firstly, although we did not find significant effects in our main analysis, the ones close to statistical significance in the expected direction pertained to intuitive participants. The hypothesis is further supported by the fact that when the analyses were computed with participants divided by terciles, the abovementioned trends for intuitive participants became more prominent, whereas any deliberate participants' trend suggested by the analysis using the median, nearly disappeared. These findings suggest we were right to expect different patterns of results for intuitive and deliberate participants and that the metacognitive advantage found in Mata et al. (2013)'s experiments may make deliberate participants less vulnerable to social influence.

Finally, an analysis of the reaction times revealed that participants took longer to solve the problems when there was a conflict between the answers of the majority and minority, indicating that they were not indifferent to the presence of an ally or dissident.

Limitations and Future Research

In sum, although social influence impacted intuitive participants in the expected direction in the experimental phase, most of our initial hypotheses were not fully supported by the present findings. Several reasons may have contributed to this. First, it should be noted that, after classifying the different types of participants into intuitive participants (N = 63) and deliberate participants (N = 62) by the median, the n associated to each type of participant in

each condition was very small (M = 15.63 participants per condition), which might be one of the reasons why the effects did not reach significance[5]. Future studies should collect data from a larger number of participants.

Second, this study was conducted with second-year psychology students, many of which had some knowledge concerning Asch's experimental paradigm and main findings. Therefore, it might be the case that some students noticed the similarity between Asch's study and the present one, which introduced experimental noise in our results. As such, to counter this problem, a new study should be conducted with naïve participants.

Third, while reading the comments left by participants, we also noticed that many of them reacted to the stereotypes in the problems in a somewhat unexpected way – indicating that they were against the use of stereotypes and some even stating they deliberately tried to oppose them. This could have also introduced noise in our data as these participants were not interpreting the task as intended. This issue could be bypassed by running a similar study using reasoning problems that are not as dependent on such stereotypical descriptions (e.g., CRT problems).

Another limitation of the present study is the context in which it took place. Due to the current pandemic situation, contrarily to most of the previous research using the Asch paradigm, this study had to be conducted online. Participants who took part in the original experiments reported feelings of fear of social rejection or of appearing less capable; however, in computer-mediated communications (CMC) there is less normative interpersonal or social pressure (Bordia, 1997) and participants seem less concerned with what others might think of them, as they are distracted from the social context (Siegel et al., 1986). Additionally, Smilowitz et al. (1988) tried to replicate Asch's studies in an online setting, having participants

[5] When participants were divided by terciles – i.e., intuitive participants (N = 33), neutral participants (N = 56) and deliberate participants (N = 36), the n associated to each type of participant in each condition was even smaller (M = 10.42 participants per condition).

and confederates solving the line comparison tasks through a computer, and concluded that there is less conformity in CMC environments. As such, the online context of the present study is a possible reason as to why the results we obtained were less clear than expected. It follows that a future study, with the same material, should be conducted in a laboratory setting, as were Asch's studies, so as to circumvent this issue.

Aside from the abovementioned proposed studies to tackle the current study's limitations, there are other studies that should be interesting to run in the future. People usually feel more pressured to conform to group norm when faced with individuals from an ingroup (vs. outgroup); indeed, the more salient a membership category is, the more ingroup-normative one's behavior becomes (Abrams & Hogg, 1990). Additionally, there is also research showing that a judgement from an ingroup source produces more influence on the individual than judgements by an outgroup source (e.g., Haslam et al., 2004; Maass et al., 1982; Platow et al., 2005; Turner et al., 1989). As such, it might be interesting to conduct a similar study to the present one, with the added variable of majority and minority membership categorization (i.e., manipulating whether the majority and minority sources are ingroup or outgroup sources). If conducted online, this study could be run using the same Qualtrics program, with the adjustment of confederates' profiles – which should include the icon, age, gender and some type of social membership identification (e.g., the school they attend). If run in a laboratory setting, using Asch's paradigm, confederates could first introduce themselves, stating their age and, for example, which school they attended. In such a study, it would be expected that intuitive participants would better resist the pressure of a deliberate majority if the members of said majority were from an outgroup than if they were from an ingroup. Still, they would be more intuitive when faced with an intuitive outgroup majority than when faced with a deliberate outgroup majority, because a) a deliberate majority could break participants' expectation of finding unanimity and, thus, create some pressure to conform (Mugny et al.,

1995) and; b) an intuitive outgroup majority responds in the same direction of the participants (which may attenuate the rejection of the outgroup), but gives more extreme intuitive answers than most participants, possible leading to even more intuitive responses from these participants. Additionally, the presence of an ally should be most effective when this ally is an ingroup member and the individual is faced with a deliberate outgroup majority, though it should still help participants resist the pressure of a deliberate ingroup majority, as suggested by the present findings.

Although we have focused on classic social influence theories, other theoretical approaches may also be used to shape future research. For instance, epistemic vigilance theory (Sperber et al., 2010) argues that human reasoning evolved for communication goals. As a result of this evolutionary process, we possess cognitive mechanisms to ensure that communication remains advantageous and to avoid being misinformed, whether intentionally or not. In other words, when we are faced with information provided by others, we are vigilant towards the trustworthiness of the source and towards its coherence with our prior knowledge or beliefs. Source trustworthiness is assessed by how competent and/or benevolent a source is, and it can be central as to whether we accept (or not) incoherent information. Incoherent information coming from a highly trustworthy source is more readily accepted than when this information is provided by an untrustworthy source. Indeed, Adam and Levine (1971) found that the presence of an ally in an Asch paradigm setting was not as effective in reducing conformity when participants had reason to believe the ally to be a low-competent source. In a similar vein, dual process models of persuasion (Bhattacherjee & Sanford; 2006; Chaiken, 1980; O'Keefe, 2008; Petty & Cacioppo, 1986; Pornpitakpan, 2004; Sussman & Siegal, 2003) consider that source of the message may be more or less persuasive depending on its perceived credibility (e.g., competence, likability, trustworthiness).

Accordingly, it could be interesting to manipulate, in a study similar to the present one, confederates' competence and/or perceived benevolence. It might be the case that participants faced with an opposing majority might be less likely to conform if the majority is presented as being incompetent or non-benevolent. On the other hand, similarly to the findings of Adam and Levine (1971), when there is an ally, participants are less likely to rely on said ally if he isn't perceived as competent or benevolent.

Dual process models of persuasion (Bhattacherjee & Sanford; 2006; Chaiken, 1980; Petty & Cacioppo, 1986; O'Keefe, 2008) further consider the quality of the persuasive message, differentiating between heuristic cues and (strong and weak) arguments. Future research could thus explore the conditions under which stereotype-based information of the base-rate problems used herein is perceived as an heuristic cue – enhancing social influence particularly when participants are processing information in a more superficial (or peripheral) way (as was the case of intuitive participants) – or as weak arguments – decreasing social influence, particularly when participants are processing information in a more deep (or central) way and are simultaneously presented with extreme base-rates (as the ones used in our problems) which are likely to be perceived as strong arguments.

Finally, task relevance has also been shown to affect participant performance and, though studies exploring the way task relevance affects conformity have had mixed results, with studies finding higher levels of conformity for relevant tasks (e.g., Baron et al., 1996; Crowne & Liverant, 1963) and others showing the opposite (e.g., Crutchfield, as cited by Krech et al., 1962; Di Vesta, 1959), it might still be interesting for a future study to manipulate task importance.

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Appendix A

Characteristics of TOP and TANI tasks (Mugny et al., 1995)

In TOP tasks, there is no objective way to determine whether a certain judgment is right or wrong, allowing for a wide variety of positions. However, different opinions are expected to be directly related to relevant social distinctions, i.e., specific opinions correspond to each social group and one can be assigned to different social groups based on their opinions. Because TOP tasks are socially anchoring, conflict elaboration is shaped by the concern to maintain ingroup agreement and outgroup disagreement and to avoid the self-attribution of negative attributes. This means that social influence processes will be dependent of the source's social category. Disagreement with a relevant ingroup source will lead to a normative conflict, which is generally resolved by conforming to the ingroup. On the other hand, a conflict introduced by an outgroup is one of an intergroup nature. Here, individuals will mostly maintain or accentuate social differentiation between groups at the manifest level (Doise, 1978; Tajfel, 1978), though this outgroup discrimination can produce latent change – conversion effect (Moscovici, 1980).

Contrarily to TOP tasks, judgements made in TANI tasks are not telling of a specific social membership or ranking. Thus, the expression of one's judgement does not carry any social consequences for their self-image or perceived aptitude. It follows that when expressing an opinion in a TANI task, people do not expect to reach a consensus and differing views of others will not introduce a conflict. As such, social influence effects are not expected to take place in TANI tasks.

Appendix B

Non-conflict problems results

Pre-test Phase

Before starting the analysis, participants' response scale was inverted, so that answers lower than the mid-point of the scale (3) were intuitive, while answers higher than the mid-point were deliberate. Mean performance for the pre-test phase was calculated for each participant. Participants were then divided by the median of participant's mean performance (2.67), such that participants with a mean performance lower than the median were classified as intuitive participants (N = 63) (i.e., in average these participants judge the stereotype-based response as more likely than the response according to extreme base-rates; M = 2.10, SE = 0.06). Participants with an average score equal or higher than median (2.67) were classified as deliberate (N = 62) (i.e., these participants considered the base-rates response more likely or at least they show some sensitivity to the base-rates by responding in the mid-point of the scale; M = 4.05, SE = 0.09).

Experimental phase

Performance. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects (Table B1).

Table B1

Participants' mean performance for each condition

Participant Condition	Marginal Mean	Lower	Upper	SE
1	2.054	1.799	2.308	0.128
2	1.79	1.525	2.054	0.134
3	1.694	1.427	1.961	0.135
4	1.728	1.478	1.978	0.126

Response times. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects (Table B2).

Table B2

Participants' mean response time for each condition

Participant Condition	Marginal Mean	Lower	Upper	SE
1	9.576	8.058	11.095	0.767
2	8.197	6.617	9.776	0.798
3	9.645	8.052	11.238	0.804
4	9.92	8.426	11.414	0.754

Confidence. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects (Table B3)[6].

Table B3

Participants' mean confidence for each condition

Participant Condition	Marginal Mean	Lower	Upper	SE
1	4.157	3.957	4.356	0.101
2	4.065	3.858	4.273	0.105
3	4.109	3.9	4.318	0.106
4	4.077	3.881	4.273	0.099

[6] To confirm these findings, participants were divided in three groups using terciles. intuitive participants (N=33), neutral participants (N=56) and deliberate participants (N=36). The same pattern of results was found for all three measures (i.e., performance, response times and confidence).

Appendix C

Participants' means for each condition for the exploratory measures

Table C1

Participants' mean rating of confederates' responses

Participant Condition	Marginal Mean	Lower	Upper	SE
1	3.252	3.011	3.494	0.122
2	3.205	2.951	3.458	0.128

Table C2

Participants' mean agreement with the statement "I avoided following confederates' responses"

Participant Condition	Marginal Mean	Lower	Upper	SE
1	3.808	3.527	4.09	0.142
2	3.863	3.565	4.162	0.151

Table C3

Participants' mean agreement with the statement "I avoided going against confederates' responses"

Participant Condition	Marginal Mean	Lower	Upper	SE
1	1.889	1.623	2.156	0.135
2	1.894	1.611	2.176	0.143

Table C4

Participants' mean agreement with the statement "I was influenced by confederates' responses"

Participant Condition	Marginal Mean	Lower	Upper	SE
1	1.834	1.601	2.067	0.118
2	1.656	1.409	1.903	0.125

Appendix D

Results when analysis were run after dividing participants by terciles

Pre-test Phase

Before starting the analysis, participants' response scale was inverted, so that answers lower than the mid-point of the scale (3) were intuitive, while answers higher than the mid-point were deliberate. Mean performance for the pre-test phase was calculated for each participant. Participants were then divided into three groups using terciles, participants with a mean performance equal or lower than 2.33 were classified as intuitive participants (N = 33) (i.e., in average these participants judge the stereotype-based response as more likely than the response according to base-rates; M = 1.75, SE = 0.06). Participants with a mean performance higher than 3.67 were classified as deliberate (N = 36) (i.e., these participants considered the base-rates response more likely than the response according to the stereotypical description; M = 4.58, SE = 0.08). Other participants were classified as neutral (N = 56) (i.e., these participants deemed the base-rates response as likely as the stereotype-based response; M = 2.87, SE = 0.06).

Exploratory Measures

Before moving on to the main analysis, exploratory measures were analyzed to see how participants reacted to the confederates. For this participants' rating of confederates' performance and participants' agreement with a set of sentences concerning their own performance (i.e., "I avoided following others' responses", "I didn't want to go against others' responses" and "I was very influenced by others' responses") will be analyzed. The deliberate majority with an intuitive dissident and intuitive majority with a deliberate dissident conditions were not included in the reported exploratory analysis, as confederates' answers were not

unanimous and, so, we do not know if participants responded to these measures with only the dissident, only the majority or a mix of both in mind.

When analyzing how participants rated confederates' performances, a between-subjects analysis of variance (ANOVA) with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully intuitive majority (C1) vs. fully deliberate majority (C2)) as factors, revealed no significant effects. However, intuitive participants' trend shows that they rated confederates' performance more positively when faced with a fully intuitive majority than when faced with a fully deliberate majority (M_{C1} = 3.67, SE_{C1} = 0.25 vs. M_{C2} = 3.28, SE_{C2} = 0.23).

When analyzing participants' reports on whether they agreed with the statement "I avoided following confederates' responses", a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority) as factors, revealed no significant effects. Tough there were no significant effects, participants' trend shows that deliberate participants agreed more strongly with the statement (M = 4.06, SE = 0.19), followed by neutral participants (M = 3.79, SE = 0.16) and intuitive participants (M = 3.70, SE = 0.20).

When analyzing participants' reports on whether they agreed with the statement "I avoided going against confederates' responses", a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority) as factors, revealed a main effect of baseline categorization, $F(1, 119) = 4.12$, $p = .019$, $\eta_p^2 = .07$, such that neutral participants disagreed with the statement more strongly (M = 1.59, SE = 0.14), followed by intuitive participants (M = 2.23, SE = 0.19) and deliberate participants (M = 2.03, SE = 0.18). Additionally, participants' trend shows that intuitive participants disagreed more strongly with

the statement when faced with a fully deliberate majority than when faced with a fully intuitive majority (M_{C2} = 2.00, SE_{C2} = 0.25 vs. M_{C1} = 2.47, SE_{C1} = 0.28); contrarily, deliberate participants disagreed more strongly with the statement when faced with a fully intuitive majority than when faced with a fully deliberate majority (M_{C1} = 1.95, SE_{C1} = 0.25 vs. M_{C2} = 2.12, SE_{C2} = 0.26).

When analyzing participants' reports on whether they agreed with the statement "I was influenced by confederates' responses", a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority) as factors, revealed a main effect of baseline categorization, $F(1, 119) = 3.06$, $p = .050$, $\eta_p^2 = .05$, such that deliberate participants disagreed with the statement more strongly (M = 1.50, SE = 0.16), followed by neutral participants (M = 1.74, SE = 0.13) and intuitive participants (M = 2.06, SE = 0.17). Though the baseline categorization × participant condition interaction was not significant, $F(1, 119) = 1.75$, $p = .179$, planned comparisons revealed that intuitive participants disagreed with the statement less strongly in the fully intuitive condition than in the fully deliberate condition (M_{C1} = 2.40, SE_{C1} = 0.25 vs. M_{C2} = 1.72, SE_{C2} = 0.22; $t(119) = 2.05$, p = .043).

Taken together, these results suggest that intuitive participants were not indifferent to the answers given by confederates, given that their answers varied when faced with a fully intuitive majority and when faced with a fully deliberate majority.

Experimental Phase

Performance. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully

intuitive majority (C1) vs. fully deliberate majority (C2) vs. deliberate majority with an intuitive dissident (C3) vs. intuitive majority with a deliberate dissident (C4)) as factors, revealed a main effect of baseline categorization, $F(1, 113) = 60.40$, $p < .001$, $\eta_p^2 = .52$, such that intuitive participants gave more intuitive responses ($M = 2.36$, $SE = 0.14$), deliberate participants gave more deliberate responses ($M = 4.29$, $SD = 0.13$) and neutral participants gave responses nearing the mid-point of the scale (3) ($M = 2.81$, $SD = 0.11$) (Figure D1). No other results reached statistical significance (including the baseline categorization × participant condition interaction, $F(1, 113) = .65$, $p = .691$). However, to test our hypothesis that intuitive participants would be more intuitive when faced with a fully intuitive majority than when faced with a fully deliberate majority, a planned contrast between the fully intuitive and fully deliberate conditions for this type of participants was computed. Though this difference was not significant, $t(113) = -1.18$, $p = .239$, intuitive participant's trend is in line with what was expected – they are less intuitive when faced with a fully deliberate majority than when faced with a fully intuitive majority ($M_{C2} = 2.67$, $SE_{C2} = 0.25$ vs. $M_{C1} = 2.24$, $SE_{C1} = 0.25$).

To test the hypothesis that intuitive participants would be more intuitive when faced with a deliberate majority with an intuitive dissident than when faced with a fully deliberate majority, a planned contrast between these conditions was computed, revealing that intuitive participants were less intuitive when faced with a fully deliberate majority than when faced with a deliberate majority with an intuitive dissident ($M_{C2} = 2.67$, $SE_{C2} = 0.25$ vs. $M_{C3} = 2.00$, $SE_{C3} = 0.25$; $t(113) = 1.85$, $p = .066$). Although this difference is only marginally significant.

Another planned contrast was computed to test the hypothesis that deliberate participants would be less deliberate when faced with a fully intuitive majority than when faced with a fully deliberate majority, revealing no significant difference between deliberate participants' answers in these conditions, $t(113) = -0.51$, $p = .612$.

A final planned contrast was computed to test the hypothesis that deliberate participants would be less deliberate when faced with a fully intuitive majority than when faced with an intuitive majority with a deliberate dissident, revealing no significant difference between deliberate participants' answers in these conditions, $t(113) = -0.68$, $p = .500$ (Table D1).

Figure D1

Participants Performance on Experimental Phase

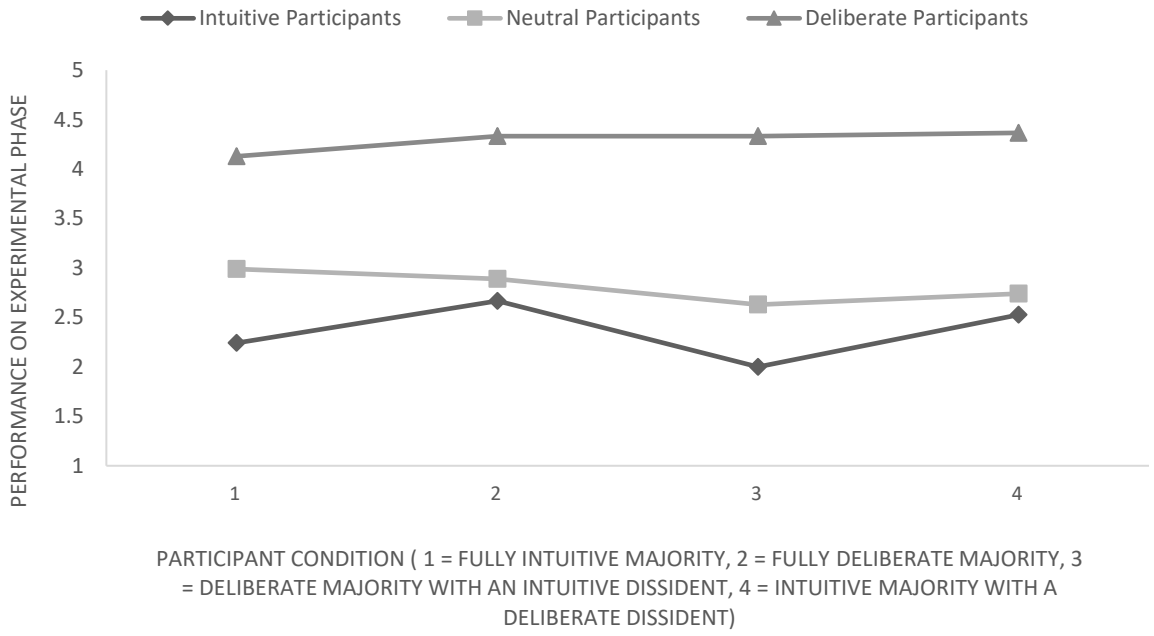


Table D1

Planned contrasts results

Comparison	Estimate	SE	df	t	p
Intuitive participants					
Condition 1 vs Condition 2	-0.426	0.36	113	-1.183	0.239
Condition 2 vs Condition 3	0.667	0.36	113	1.854	0.066
Condition 1 vs Condition 4	-0.286	0.402	113	-0.71	0.479
Deliberate participants					
Condition 1 vs Condition 2	-0.204	0.402	113	-0.509	0.612
Condition 2 vs Condition 3	6.061e -4	0.387	113	0.002	0.999
Condition 1 vs Condition 4	-0.237	0.35	113	-0.677	0.5

Response times. Response times (converted to $\log_{10}$) were analyzed in a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors. The ANOVA revealed a marginal main effect of participant condition, $F(1, 113) = 2.62$, $p = .054$, $\eta_p^2 = .07$, such that participants took more time in the followed by the intuitive majority with a deliberate dissident condition ($M_{C4} = 0.96$, $SE_{C4} = 0.04$), deliberate majority with an intuitive dissident condition ($M_{C3} = 0.90$, $SE_{C3} = 0.04$), the fully intuitive majority condition ($M_{C1} = 0.87$, $SE_{C1} = 0.03$) and, finally, the fully deliberate majority condition ($M_{C2} = 0.82$, $SE_{C2} = 0.04$). This, again, shows that participants were not indifferent to confederates' responses, as they took longer to answer when confederates' responses were not unanimous – suggesting that they detected the conflict between confederates' responses. Though baseline categorization × participant condition interaction was not significant, $F(1, 113) = 1.16$, $p = .331$, planned comparisons revealed a significant

difference between deliberate participants' response times when faced with a fully intuitive majority and when faced with a fully deliberate majority, $t(113) = 2.26$, $p = .026$, such that deliberate participants took less time to solve the problem when faced with a fully deliberate majority than when faced with a fully intuitive majority ($M_{C2} = 0.69$, $SE_{C2} = 0.08$ vs. $M_{C1} = 0.92$, $SE_{C1} = 0.06$). A significant difference between deliberate participants' response times when faced with a fully deliberate majority and when faced with a deliberate majority with an intuitive dissident, $t(113) = -2.26$, $p = .026$, was also revealed, such that deliberate participants took less time to solve the problem when faced with a fully deliberate majority than when faced with a deliberate majority with an intuitive dissident ($M_{C2} = 0.69$, $SE_{C2} = 0.08$ vs. $M_{C3} = 0.91$, $SE_{C3} = 0.06$).

Confidence. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects.

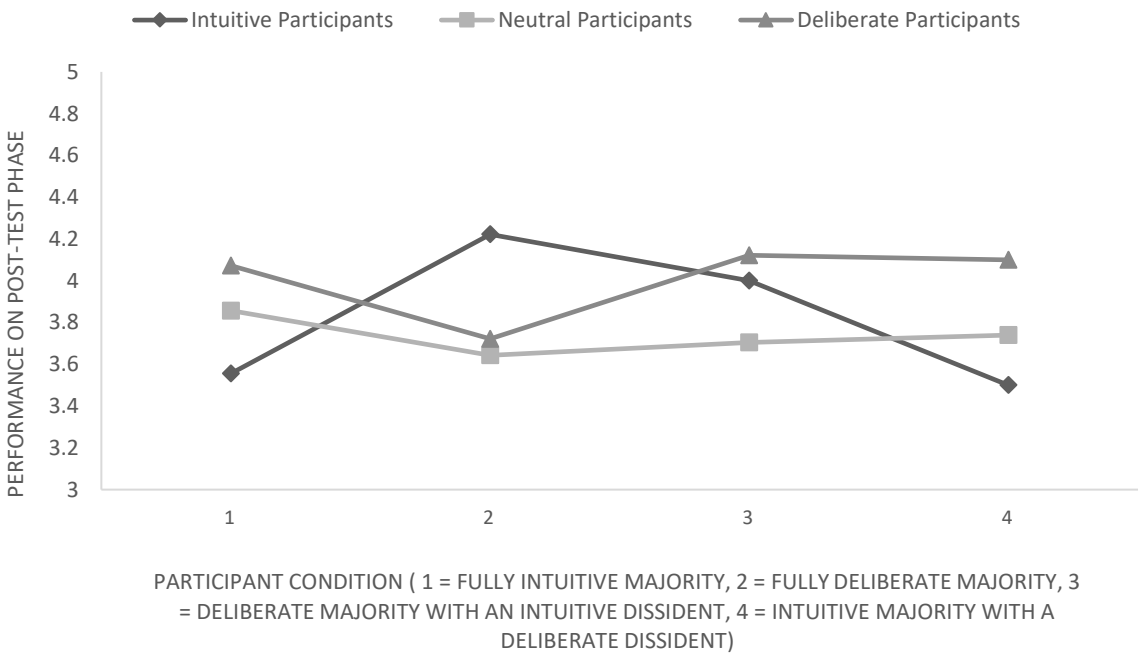
Post-test Phase

Performance. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. neutral vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed a main effect of baseline categorization, $F(1, 113) = 57.47$, $p < .001$, $\eta_p^2 = .50$, such that intuitive participants gave more intuitive responses ($M = 2.18$, $SE = 0.15$), deliberate participants gave more deliberate

responses (M = 4.24, SE = 0.14) and neutral participants gave responses nearing the mid-point of the scale (3) (M = 2.71, SE = 0.11)(Figure D2). No other significant effects were found.

Figure D2

Participants Performance on the Post-test Phase



Response times. Response times (converted to $\log_{10}$) were analyzed in a between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors. The ANOVA revealed no significant effects.

Confidence. A between-subjects ANOVA with baseline categorization based on performance on the pre-test (intuitive vs. deliberate) and participant condition (fully intuitive majority vs. fully deliberate majority vs. deliberate majority with an intuitive dissident vs. intuitive majority with a deliberate dissident) as factors, revealed no significant effects.

Appendix E

Participants' mean response times and confidence for each condition on the experimental phase

Table E1

Participants' mean response times for each condition on the experimental phase

Participant Condition	Marginal Mean	Lower	Upper	SE
1	0.87	0.803	0.936	0.034
2	0.826	0.757	0.895	0.035
3	0.901	0.831	0.97	0.035
4	0.961	0.896	1.027	0.033

Table E2

Participants' mean confidence for each condition on the experimental phase

Participant Condition	Marginal Mean	Lower	Upper	SE
1	3.91	3.71	4.11	0.101
2	3.773	3.565	3.982	0.105
3	3.916	3.706	4.126	0.106
4	3.873	3.676	4.069	0.099

Appendix F

Participants' mean response times and confidence for each condition on the post-test phase

Table F1

Participants' mean response times for each condition on the post-test phase

Participant Condition	Marginal Mean	Lower	Upper	SE
1	1.298	1.232	1.364	0.033
2	1.292	1.223	1.36	0.034
3	1.299	1.23	1.368	0.035
4	1.303	1.238	1.367	0.033

Table F2

Participants' mean confidence for each condition on the post-test phase

Participant Condition	Marginal Mean	Lower	Upper	SE
1	3.843	3.619	4.067	0.113
2	3.813	3.58	4.046	0.118
3	3.956	3.721	4.19	0.119
4	3.79	3.57	4.01	0.111