Social Influence and Position Effects[*]

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November 17, 2020

A wide range of personal choices rely on the opinions or ratings of other individuals. This information has recently become a convenient way of simplifying the decision process. For instance, in online purchases of products and services, the possible choices or alternatives are often characterized by their position in a certain presentation order (or list) and their popularity, derived from an aggregate signal of the behavior of others. We have performed a laboratory experiment to quantify and compare popularity (or social influence) and position effects in a stylized setting of homogeneous preferences, with a small number of alternatives but considerable time constraints. Our design allows for the distinction between two phases in the decision process: (1) how agents search (i.e., not only which alternatives are analyzed but also in which order) and (2) how they ultimately choose. We find that in this process there are significant popularity and position effects. Position effects are stronger than social influence effects for predicting the searching behavior, however, social influence determines to a larger extent the actual choice. The reason is that social influence generates a double effect; it directly affects the final choice (independently on what alternative has been searched more thoroughly) and indirectly alters choice through the searching behavior which, in turn, is also affected by popularity. A novelty of our approach is that we account for personal traits and provide an individual analysis of sensitivity to both social influence and position effects. Surprisingly, we find that overconfident individuals are more influenceable, whereas other personal characteristics (e.g., gender and risk aversion) do not play a significant role in this context.

Keywords: social influence, ranking, searching behavior, lab experiments.

JEL Classification Numbers: C91, D03, D81

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[*] We would like to thank Ismael Rodríguez, Maria de Paola, Marcello Sartarelli, Pedro Rey, Iñigo Iturbe and Pablo Brañas for helpful comments. Thanks are due to two anonymous referees for valuable comments that have substantially improved the analysis of the paper. We also thank seminar participants at 2017 Lisbon Meeting in Game Theory and Applications, 2017 Sevilla NORMA Workshop, 2017 Málaga BiNoMa Workshop, 2018 ESA World Meeting and SABE-IAERP 2018. We acknowledge support from the University Pablo de Olavide (PPI1701) and from Ministerio de Ciencia, Innovación y Universidades (ECO2016-76789-P, ECO 2017-83147-c2-1-P, ECO 2017-83147-c2-2-P, ECO2017-83069-P).

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1. Introduction

Most personal choices depend on the opinions or ratings of other individuals (i.e., selecting car insurance, doctors, restaurants, hotels, etc.). This general phenomenon, often referred to as social influence, has multiple psychological and economic origins (Cialdini, 2006). For instance, an individual might be susceptible to social influence in order to identify with others (normative conformity), or to infer relevant information from them (informational conformity).[1],[2] Certainly, in many real-world cases, social influence can be explained by a combination of motives and its universal and multifaceted nature makes it a topic of primary interest in social and economic science (Watts, 2007).

There are many ways in which social influence can operate. For instance, the incursion of Internet in our everyday lives has increasingly led to the availability of a vast amount of information which is often challenging to evaluate. As a consequence, online intermediaries have emerged, offering individuals a simplified searching process by providing default rankings of the possible choices or alternatives. On one side, these intermediaries give the chance to rank the alternatives according (either explicitly or implicitly) to popularity, but on the other side, the set of possible options must necessarily be presented in a certain order. Disentangling the popularity (or social influence) effect from the purely framing effect (i.e., the position of alternatives) is not straightforward. Moreover, despite its importance, to demonstrate that individuals' decisions are affected by the behavior of others' choices is complicated due to standard identification problems (Manski, 1993).

Laboratory experiments allow us the analysis of behavior in a highly controlled environment, avoiding at the same time a series of problems common to field data, in particular, those derived from Internet-based experiments. For instance, in laboratory experiments we can guarantee that individuals are taking their decisions on their own, induce common time constraints, and collect personal characteristics, which may be relevant for explaining the individual’s behavior but are difficult to properly determine in an online field experiment. Another aspect that is accurately described in the lab

[1] See Festinger et al. (1950) or Asch (1953) for classical studies on normative conformity and Mavrodiev (2013) or Brandts et al. (2015) for works on informational conformity. Also, Goeree and Yariv (2015) and Fatás et al. (2018) ran an experiment to test which of these conformity motives is more relevant. Finally, Moreno et al. (2019) discuss these types of conformity preferences but applied to a voting setting.

[2] See e.g., López-Pintado and Watts (2008) and references therein for other examples where social influence matters.

relates to details of the searching behavior. Namely, we measure the order in which the alternatives are opened as well as the time dedicated to analyzing each of them which turns out to be relevant for our results.

We have performed a laboratory experiment to quantify and compare social influence and position effects in a stylized setting of homogeneous preferences, with a small number of alternatives but strong time constraints. We compare these effects in two subsequent phases of the individuals' behavior: the individuals' searching strategy and the actual final choice. The main novelty in our design, with respect to previous studies, is that there is an objective ranking of alternatives from the best to the worst, which is the same for all participants and has to be guessed by them. Therefore, incentives are aligned, and preferences are completely homogeneous across individuals.[3] The "correct ranking" is discovered by participants only after a careful examination of the different alternatives, which requires some basic knowledge and time.

In the experiment, we considered an abstract context in which participants had to perform a reading or "text task". They had to find the number of typos (and misspellings) in three different pieces of text that appear in a default order, from top to bottom, on the computer screen. After clicking on one of the corresponding buttons labeled as text A, B and C, a certain text appeared and could be evaluated. Subjects could open and analyze each text as many times and in any order as wished within a given time limit. Then, they were asked to submit a ranking of these texts such that placing the text with the highest number of typos first, the second one second, and so on, maximized payoffs. In some treatments (i.e., the social influence treatments), the popularity of an alternative (i.e., text), represented by a certain number of stars, was also provided. This information is based on what some other participants chose in previous sessions of the experiment. This social signal, however, is deliberately described in a vague manner to subjects. For instance, participants do not know the exact number of previous responses used to construct the signals, nor the personal characteristics and context of those subjects from which they are derived (a common feature in most real-life situations). Finally, we measured the individual's ability in the text task through trial rounds prior to the experiment, whereas other personal characteristics and some socio-

[3] In reality, there are many goods and services for which people have quite homogeneous preferences either because of their own nature (e.g., simple products with a reduced number of characteristics as energy supplies, from electricity to batteries) or as a result of some reduction in the consumption set (e.g., by restricting the search of hotels to those with a small price variation in the center of a touristic city).

demographic variables were collected through a questionnaire at the end of the experiment.

We find that both social influence and position effects exist. In the absence of information about the popularity of alternatives (i.e., the no-social influence treatments), the presentation order significantly induces choices, mainly because individuals tend to select the alternatives that have been carefully analyzed, and this is highly correlated with their position due to simple framing effects. However, if the popularity of alternatives is also provided (i.e., the social influence treatments), and even though position effects are stronger than social influence effects for the searching behavior in isolation (i.e., often individuals analyze the alternatives in the order in which they are presented), social influence determines to a larger extent the actual choice. This is so because the overall impact of social influence operates via the two phases involved in the decision process: the popularity of an alternative directly affects its choice and indirectly via the searching behavior which in turn affects the final decision as well.

Lastly, we conducted a regression analysis to study some determinants of social influence and position effects on individual decisions. Interestingly, we find that overconfident individuals are more inclined to social influence both for the searching behavior and the actual choice (where overconfidence is measured as the discrepancies between how individuals believe they have performed, and how they indeed have performed). Also, wealthier and arrogant individuals are less sensitive, regarding their final choices, to position effects. Surprisingly, none of the other individual characteristics collected (e.g., gender or risk aversion) play a significant role in behavior.

There are many studies on the role of social influence on individuals' decisions. Regarding field experiments, for instance, an online music market has been investigated by Salganick et al. (2006). This work eloquently shows evidence of the unpredictability of the most successful songs in terms of downloads due to the snowball effect generated over time by social influence. Similarly, Cai et al. (2009) designed an experiment to explain the effect of explicitly showing the most popular dishes on a restaurant menu on consumer choices in an attempt to disentangle social influence from other framing effects. As we do, this last study finds that social influence effects are more important than the other framing effects investigated. Finally, Hogg and Lerman (2015) experimentally measured the effects of social signals in peer recommendation of a list of preselected “science stories” and compared it with position effects. Opposite to our findings, they showed that an item's popularity affects its recommendation about half as much as position.[4]

Most of these previous studies do not differentiate between the searching process and the final choice, which is one of the additional novelties of our approach. Nevertheless, there is also a rich literature in marketing analyzing the effects of online rankings separating between consumer's search and consumer's choice. For instance, Ghose et al. (2014), using archival data from a real-hotel search engine application analyze the interaction between a search engine ranking and a ranking based on ratings. Their main findings are that an inferior position on the search engine affects "top popular" hotels more adversely than less popular ones; and those hotels with a lower customer rating are more likely to benefit from being placed on the top of the screen. Also, Ursu (2018) employed the first dataset with experimental variation in the observed order of alternatives from the world's largest online travel agent (Expedia) and found that rankings affect what consumers search, but conditional on search, do not affect purchases. In our case, however, the popularity ranking does affect choices, even when conditioning on search.

There are several fundamental aspects that distinguish our approach from Ursu's one and almost all the other related literature mentioned above (field experiments on social influence in general and those focused on marketing).[5] First, in our case individuals have aligned preferences which reduces the complexity of the setting significantly and allows us to better identify the impact of framing (position) and popularity effects on individual decision. Therefore, a crucial contribution of our experiment to this literature is that social influence can be measured in a clearer way since there exists a correct ranking which is common to all participants, and different from the popularity and the presentation ranking.[6] Second, we have far more information regarding the personal characteristics of participants and their searching process. Whereas in previous studies on online rankings the searching behavior was simply measured by the number of

[4] In addition, Muchnik et al. (2013), using a large-scale randomized experiment, analyze the effects of ratings on social news aggregation. Mavrodiev et al. (2013) analyze how the nature of the response of factual questions crucially depends on the level of information aggregation about the answers of others.

[5] There are other related studies that, however, do not study these two features of the products (popularity and position). For instance, Agarwal et al. (2011) and Blake et al., (2015) studied the revenues of sponsored ads through keywords and found that the topmost position is not necessarily the profit-maximizing position. De los Santos and Koulayev (2017) exploit a web-based hotel comparison platform in order to estimate an optimal model of search based on the expected consumer type and the search requested parameter.

[6] Jindal and Aribarg (2015) analyze a context with aligned preferences but focus on understanding behavior due to heterogeneity in believes regarding prices, which is beyond the scope of our paper.

“clicks” an alternative received, in our experiments we also tracked the order in which agents searched the alternatives and the time spent in each of them. These precise measures of individuals’ searching behavior allow us to better understand the reasons leading to the individuals’ choice.

Finally, there are relevant theoretical studies on context-dependent choice which are also related to our study. For instance, there have been several models addressing the role of attention (Dijksterhuis et al., 2006 and Van Loo et al., 2015), salience (Bordalo et al., 2013 and Schwartzstein, 2014) and searching fatigue (Carlin and Ederer, 2019). The effects of time constraints have been vastly analyzed experimentally (Kocher and Sutter, 2006 and Shurchkov, 2012), but in contexts absent of social influence.

The paper is organized as follows. In Section 2, we describe in detail the experimental design. In Section 3, we formally outline the main hypotheses, and in Section 4, we present the results. A discussion and some conclusions of the paper are presented in Section 5, which is followed by Appendices A to E.

2. Experimental Design

2.1 The task

In the experiment, subjects faced a task that consisted of obtaining the number of typos and misspellings in different texts of similar length. The value associated with a text coincided with its number of misspellings or typos. In particular, all subjects confronted the same three texts, each associated with a certain (objective) value. This value could be high (*H*, hereafter, with value 12), medium (*M*, with value 9) or low (*L*, with value 6). Furthermore, the texts appeared ranked on a computer screen, and their content could be observed only after double-clicking on their corresponding screen buttons, which, for simplicity, were named from top to bottom Text A, Text B and Text C. For example, if a participant clicked B, then the corresponding text would appear occupying the whole screen. The participants had a limited time (180 seconds) to read and analyze all three texts, and within such a time range, they could open each text as many times and in any order they wished. Once the time elapsed, participants were asked to choose an order of such alternatives r, where $r \in \{ABC, BAC, ACB, BCA, CAB, CBA\}$. Notice that individuals' choice is a vector. The reason for this is that we wanted to credibly obtain the maximum information from the subjects as possible. By asking a vector we have the whole preference order that allows us to investigate social influence and position effects in different ways (e.g., which alternative is chosen as first, depending on its popularity, or instead, which alternative is selected as last). A feasible interpretation of this type of decision in reality would be agents ordering the alternatives from their preferred option to the least preferred one to later check for availability following such an order (e.g., when searching for hotels, restaurants, etc.). The payoff function given to agents was expressed in ECUS (our experimental currency) and consisted of the following:

$$\Pi(r)=6v(r_1)+3v(r_2), \tag{1}$$

where $v(r_i)$ is the (correct) value of the text placed in position i by the agent. Observe that the weight associated with the value of the alternative placed as first is twice the weight associated with the value of the alternative placed as second, whereas the last alternative is not relevant for payoffs. Therefore, if an agent had the ability and time to discover the values of the texts correctly then, ordering them from highest to lowest value would be the optimal choice.[7] We tried to make sure that all agents understood that payoffs given by (1) implied such optimal response. Notice that, as individuals' choice is a vector, the payoff function depends not only on the first choice selected, but on that whole vector r.[8]

We also included a calculus task to check the robustness of the results. This task consisted of finding the highest input in a matrix by computing the corresponding subtractions indicated in each cell. Half of the population began with the calculus tasks (i.e., analyzing three matrices) and continued with the reading tasks, whereas the other half did the tasks in the reverse order (see the Instructions in Appendix A). Even though most of the results obtained for the matrix task are in line with those obtained for the text task, we believe they are less solid for several reasons. First, subjects' ability,

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[7] This design captures some of the main ingredients of online decisions on purchases. The list of alternatives resembles the list of products or services (hotels, books, etc.) whereas the number of typos refer to the features of the product which determine its value for the consumer. Moreover, if subjects had unlimited time (and sufficient skills) to analyze all the alternatives in detail, they would be able to provide the correct ranking according to their preferences. But, similar to real life decisions, time is limited and thus, decisions are taken under some degree of uncertainty.

[8] The reason why we do not incentivize the third text is to make instructions simpler to understand. However, incentivizing it is mathematically equivalent to not doing so in order to maximize payoffs. Observe that, having all the weights in the payoff function strictly positive would have been analogous as long as these weights decrease with the position of the texts in the ranking.

collected through trial rounds prior to the experiment, was more homogeneous in the reading task than in the calculus one. Second, and more importantly, half of the participants erroneously believe they had time to analyze all the matrix tasks (this did not imply a large fraction of correct choices). The latter makes it difficult to properly analyze social influence or position effects since participants may choose according to the wrong valuations they have computed. In fact, when analyzing the descriptive statistics and the econometric analysis we discovered several incongruities that we did not find in the text task (further details in Section 4 below).[9] In sum, throughout the paper, we will focus exclusively on the reading task.

2.2 Treatments

Two types of treatments were considered: those in which agents had no information about the behavior of others, i.e., the no-social influence treatments, and those in which agents had some information about the behavior of others, i.e., the social influence treatments. The popularity of an alternative was introduced through stars accompanying each text. In particular, participants were informed in the instructions that the "three stars" corresponded with the choice selected most often as first by some other participants. The "two stars" corresponded with the second choice selected most often as first. Lastly, "one star" indicated that such an alternative was selected as first the least often. The information transmitted to the participants about how the social influence signal was created was quite vague. This allowed us to select a subset of the participants' decisions in the no-social influence treatments to justify two different popularity orders employed in the social influence treatments, but neither of these orders corresponded with the correct answer (i.e., the one maximizing payoffs).

We conducted six treatments, two of them to test position effects in isolation (i.e., the no-social influence treatments mentioned above) and four of them to test popularity effects and position effects jointly (i.e., the social influence treatments). In all treatments, participants faced the three alternatives described above (i.e., H, M and L) on a computer screen and these alternatives where presented in two different and preselected orders, which we name O_1=MHL, O_2=HLM. In the social influence

[9] In particular, our econometric analysis reveals that the value of an alternative has a negative and significant effect on the probability of being chosen as first.

treatments, the popularity of alternatives also ranked them following one of these two orders. To clarify, hereafter, we will say that the position or presentation order in a treatment followed O_1 (O_2) if alternative in position A is M (H), alternative in position B is H (L) and alternative in position C is L (M). Moreover, we will say that the popularity or social influence order in a treatment followed O_1 (O_2) if the alternative with three stars is M (H), the alternative with two stars is H (L) and alternative with one star is L (M).

Notice that there are six potential ways in which the three alternatives could be ordered. We decided to focus precisely on O_1 and O_2 for the following reasons. First, we discarded the "correct order" (i.e., HML, from highest to lowest number of typos) because disentangling whether the choice was driven by the presentation order or because this order was the correct one would have been difficult. We also ruled out the "opposite to correct order" (i.e., LMH) to avoid suspicion by the participants when presenting such extreme dissonant order with respect to the correct answer. Then, after discarding the correct and opposite orders, there are four remaining ones that could have been considered in the treatments, namely, O_1=MHL, O_2=HLM, O_3=MLH and O_4=LHM. Now, notice that the first two are comparable since both are derived from a unique consecutive permutation of the correct vector (e.g., permutation of H and M in O_1 and permutation of L and M in O_2). This implies that, following the standard distance proposed by Kemeny (1958), O_1 and O_2 are both at a distance of one to the correct order (defined above). In addition, O_1 and O_2 are payoff equivalent as they both would provide 90 ECUS to subjects selecting them as their final choice. Lastly, these are the only orders (among the four mentioned above) that, when combined for position and social influence as explained in more detail below, provide a casuistic large enough to account for treatments in which alternative A has three, two and one star. Likewise, the alternative with three stars occupies position A, B and C. This aspect of the design will be crucial for our econometric analysis (see Section 4.3). The treatments are defined formally next:

Treatment 1 (T_M hereafter, indicating that position A has a value of M): in this treatment social influence was absent since information about the behavior of others is not provided. The underlying presentation (or position) order was $O_1(=\mathrm{MHL})$.

Treatment 2 (T_H hereafter, indicating that position A has a value of H): in this treatment social influence was absent and the presentation order was $O_2(=\mathrm{HLM})$.

In the rest of the treatments, subjects observed the same alternatives with information about their popularity. Our choices of popularity orders can be justified based on two sizable subsamples from the no-social influence treatments. The behavioral frequencies in these subsamples correspond with the information about others provided in the social-influence treatments.[10]

Treatment 3 (T_M⋆⋆⋆ hereafter, indicating that position A has a value of M and three stars): in this treatment the presentation and popularity orders were both equal to O_1.

Treatment 4 (T_H⋆⋆⋆, hereafter, indicating that position A has a value of H and three stars): in this treatment the presentation and popularity orders were both equal to O_2.

Treatment 5 (T_M⋆ hereafter, indicating that position A has a value of M and one star): in this treatment the presentation order was O_1 and the popularity order was O_2.

Treatment 6 (T_H⋆⋆ hereafter, indicating that position A has a value of H and two stars): in this treatment the presentation order was O_2 and the popularity order was O_1

Notice that the social-influence treatments can be divided into two groups: in the first one (treatments T_M⋆⋆⋆ and T_H⋆⋆⋆), the social influence order reinforced the observed order of alternatives, whereas in the second one (treatments T_M⋆ and T_H⋆⋆), there is cognitive dissonance, since the social influence order did not reinforce the observed order or ranking of alternatives.[11] In Figure 1 we summarize all treatments and illustrate the underlying value of the texts occupying each position (see the gray letters in the white squares).

Here Figure 1

[10] In particular, there exists a subsample of size 24 from treatment T_M for which the frequency of first choices corresponds with O_1. In addition, there exists a 22-size subsample from the treatment T_H for which the frequency of first choices corresponds with O_2. Subjects in the social influence treatments had no information about the sample size or characteristics of subjects from whom the behavior was being reported. This approach facilitates the subsequent analysis since it allows us to compare the results for two pre-established popularity orders.

[11] In psychology, the term `cognitive dissonance' is the mental discomfort of a person who is presented with two or more contradictory beliefs, ideas, or values (see Festinger, 1957).

2.3 Procedures

A total of 340 subjects, 191 female and 149 male, participated in this study which took place in Seville in March 2017. Experiments were conducted in 19 sessions of 18 subjects, on average, each. All subjects were recruited from the undergraduate population of the University Pablo de Olavide (Seville). The experiment was programmed in z-Tree (Fischbacher, 2007). Subjects were recruited using ORSEE (Greiner, 2004) and earned around 8.61€ on average for an experiment that lasted approximately one hour. No one was allowed to participate in more than one session. Since the instructions were in Spanish, all participants were required to be native Spanish speakers. According to the payoff function (1), their responses induced a payoff expressed in ECUS (our experimental currency) with an exchange rate of 20 ECUS = 1€ (see instructions in Appendix A).

After reading the instructions and before starting the experiment, all subjects had to attempt tasks similar to the ones in the experiment in order to facilitate comprehension. In particular, they analyzed 2 texts. They had to provide the value (number of typos) of each text, and there was no time limit. We use the subjects' responses in these trials (i.e., the number of correct answers), as well as their time consumed, to proxy their ability.[12]

2.4 Questionnaire

At the end of the experiment, subjects completed a questionnaire that included some standard socio-demographic questions, some items to capture psychological traits and the Cognitive Reflection Test (CRT hereafter, Frederick, 2005). For socio-demographic characteristics, individuals were asked about their gender, age, field of study and family home ZIP code. Using the ZIP code and the database "Personal Income of Spanish Municipalities and its distribution-2007" (Hortas-Rico and Onrubia, 2014), we are able to assign each subject the mean and median personal income corresponding to her municipality. We consider these measures as proxies for individuals' family income. In

[12] Although the trial round was not incentivized, we believe that we can still use it to measure ability in the task for the following reasons. First, participants spent an average time of 7 minutes for the text practice. Also, the median typos reported in the text task for the two texts analyzed were 13 and 9, which are very close to the correct ones (14 and 10). Finally, Brañas-Garza et al. (2020) have recently provided evidence that individuals behave as if there were monetary incentives in all decisions taken in an experiment as long as one part of the experiment is incentivized.

addition, Table B1 in Appendix B presents the summary statistics for all variables capturing individuals' characteristics.

We also gathered some non-sociodemographic variables that might be associated with individuals' decisions in a context such as the one proposed here. We considered measures of willingness to take risk, self-confidence (i.e., how they thought they had performed in the experiment compared to others), reflectiveness, and difficulty recognizing errors. In order to elicit risk preferences, we follow Charness et al. (2013) and Gneezy and Potters (1997).[13] See Appendix B for the exact wording of these questions.

We investigate the impact some of these variables may have on the individuals' influenceability for the following reasons:

1. Gender: Several studies find differences between gender performance when these are developed under pressure (e.g., Shurchkov, 2012), which could potentially be related to influenceability in such contexts.

2. Parental income: There is empirical evidence showing that individuals from privileged families are better endowed with non-cognitive abilities (Cunha and Heckman, 2007). Among these skills, desire for control or locus of control, that is, individuals who prefer to have control over the events in their lives, is found to be negatively related to being easily influenced by others (Nezlek and Smith, 2007).

3. Risk-averse: The previous literature has studied how, in a common social setting, consultation with a group of peers affects choices under risk in the laboratory (see, for instance, Bougheas et al., 2013 and references therein). However, to the best of our knowledge, studies relating risk aversion to more influenceable attitudes are not available. For instance, does risk aversion increase or decrease influenceable behavior? This is theoretically ambiguous. On the one hand, it might be the case that more risk-averse individuals place less value on their own performance in the task (ranking of alternatives according to them) than on aggregate performance (the "popularity" ranking provided), which can be interpreted as a summary of aggregate decisions. As a result, they will tend to follow the "popularity" ranking. On the other hand, it might also be the case that more risk-averse individuals place more value on their own performance than on aggregate performance, about which, in their view, there might be considerable

[13] A disadvantage of this method might be that it cannot distinguish between risk-loving and risk-neutral preferences. However, since risk-loving preferences appear to be relatively uncommon, and a fairly small fraction of participants chose to invest the entire amount of points (below 10%), the amount invested provides a good proxy for capturing attitudes toward risk.

uncertainty. If this is the case, then more risk-averse individuals should be less sensitive to social influence.

4. Overconfidence: Confidence is a general explanatory mechanism underpinning susceptibility to social influences (see Cross et al., 2017). The intuition is that when individuals lack certainty in their own ability, following others' decisions can provide a quick and low-cost solution (Laland, 2004; Hoppitt and Laland, 2013).

5. Reflective: Resisting influence attempts is a hard task that requires individuals to expend cognitive effort and resources in order to regulate their behavior (Fransen and Fennis, 2014; Williams et al, 2017). A lack of self-control has been associated with compulsive behaviors, such as impulse-buying (Manolis and Roberts, 2012), which are likely to have parallels with susceptibility to social influence.

6. People with difficulty to recognize their mistakes (arrogant) have been proposed as being less attuned to the strength of persuasive arguments than those with fewer difficulties (Leary et al., 2017).

We also include individuals' age, field of study and ability in the regression analysis below (see Section 4.3). We do not hypothesize an effect of these variables on influenceability but include them as additional controls.

Lastly, individuals provide a self-assessed summary of their decision-making process (see Table B2 in Appendix B). Nevertheless, self-assessed measures could be biased by recall problems and subject to manipulation by students who might think they can benefit from suggesting specific personality traits (see Sternberg et al., 2000, among others). Therefore, we do not use this information in the analysis of the results and focus instead on the actual choices of individuals. Interestingly, we find a high correlation between what agents report they did in the experiment, and what they actually did.[14]

3. The basic hypotheses

Our design allows us to separately analyze the two different stages involved in the decision-making process. First, the searching behavior of agents, which will be labeled as their "opening" behavior, and second, their ranking of alternatives, which will be

[14] In particular, the correlation between choosing first in the response vector the most popular alternative and assessing having been influenced by the behavior of others was equal to 0.237, which is significant at a 1% level.

labeled as "choice" behavior. More specifically, we will focus on the following two individual outcomes: (1) For the opening strategy, we consider the alternative opened first. (2) For the choice strategy, we consider the alternative selected as first in the response vector.

There are several reasons why we limited our attention to the first alternative opened and chosen. First, we decided to focus our analysis on just one component instead of the whole vector because it is not straightforward to find an appropriate distance measure between vectors that may capture individuals' decisions. The standard distance in this setting is the one proposed by Kemeny (1959). This distance implies that the two orders of presentation (O_1 and O_2) are equivalent, as they are both at a Kemeny distance of one to the correct order. However, we do not observe similar individuals' responses when O_1 and O_2 are used (see the histograms for individuals' responses in Figure D1 in Appendix D). Second, a related problem arises while comparing individuals' responses when looking for statistical tests that compare distributions of vectors. Third, observe that, as individuals have to provide a first, second and third task, it would be enough to analyze just two of them, as the remaining one is derived from the choice of the other two. Thus, after discarding the analysis of the whole vector, we decided to focus on the first alternative opened and chosen. Again, there are several reasons for this. First, the alternative opened first is typically the one in which agents spend more time and, thus, analyze more thoroughly. In particular, in our experiment, on average, 72% of the time given to subjects was spent on analyzing the alternative opened first. Moreover, the correlation between being the alternative opened first and being the alternative in which subjects spend more time was also high (over 80% in all treatments except in T2, where it was 50%). Second, although we could also study the second alternative opened and chosen, observe that it is not possible to derive clear predictions on individuals' influenceability or position sensitivity in this case, and thus testing the main hypothesis of the paper from that analysis becomes inconclusive. That is, could we determine that individuals are more influenceable if the probability of choosing an alternative as second increases with its popularity? Finally, we think that the analysis of the third option in the response vector is not as reliable as the analysis of the first because subjects (as several of them self-reported) had the tendency to move the alternative that they didn't have time to analyze or they analyzed for just a few seconds to the last position. Nevertheless, we show results for the third alternative (opened third and positioned last in the response ranking) which confirm and reinforce our basic hypotheses (see comments below on Section 4 Results).

To formally express the hypotheses tested with our experiment, we introduce additional notation. An alternative in a ranking is characterized by two components in treatments T_M and T_H and three components in the remaining treatments. Let a=(v,p) be an alternative in treatments T_M and T_H, where $v \in \{1,2,3\}$ is the alternative's value and $p \in \{1,2,3\}$ is the alternative's position. Notice that 3 stands for the highest value or position (H or A, respectively), 2 for the intermediate value or position (M or B, respectively) and 1 for the lowest value or position (L or C, respectively). In the remaining treatments (i.e., the social-influence treatments), an alternative is characterized by three components a=(v,p,s), where the first two correspond to the same information as in the no-social influence treatments (i.e., value and position), whereas component $s \in \{1,2,3\}$ is the alternative's number of stars (⋆, ⋆⋆ and ⋆⋆⋆, respectively).

Let prob(alt=a) be the probability (or frequency) of opening or choosing as first alternative a. In fact, given our particular design, a specific alternative (characterized by its two or three components in treatments with and without social influence, respectively) only appears in one of the six possible treatments. For example, alternative (H,B,⋆⋆⋆) (or numerically (3,2,3)) only appears in T_M⋆, whereas alternative (M,A,⋆⋆⋆) (or numerically (2,3,3)) only appears in T_M⋆⋆⋆.

In what follows, we simultaneously state the hypotheses for the opening and choice decisions.

Hypothesis 1 (H1): We say that there are social influence effects if the probability of opening or choosing an alternative increases with its popularity (i.e., number of stars). Specifically,

H_1: **prob**(**alt**=(v,p,s)) is increasing in s for any given v and p

Hypothesis 2 (H2): We say that there are position effects if the probability of opening or choosing an alternative increases with its position. Specifically,

H_2: **prob** (**alt** =(v,p)) is increasing in p for any given v in the no-social influence treatments

H_2: **prob** (**alt** =(v,p,s)) is increasing in p for any given v and s in the social influence treatments

Hypothesis 3: We say that social influence effects are stronger than position effects if the following holds (H3):

H_3: **prob** (**alt** =(v,p,s))> **prob** (**alt** =(v,p´,s´)) if p´=s>p=s´ for any given v

We say that position effects are stronger than social influence effects if the following holds (H3′):

H_3': **prob** (**alt** =(v,p´,s´))> **prob** (**alt** =(v,p,s)) if p´=s>p=s´ for any given v

In other words, H3 holds if, when one compares two alternatives with equal value and where the position and number of stars are permuted, then the alternative with the highest number of stars is selected more often. For instance, the probability of selecting alternative (H,B,⋆⋆⋆) should be higher than the probability of selecting alternative (H,A,⋆⋆) if H3 holds. Similarly, H3′ holds if, when one compares two alternatives with equal value and where the position and number of stars are permuted, then the alternative in highest position is selected more often.[15]

4. Results

In this section, we describe the main results of the paper structured as follows. First, we present some summary statistics of agents' decisions to give a general overview of our findings. Second, we formally test the three hypotheses presented above. For this purpose, we compare the opening and choice decisions (on average) in different treatments according to their popularity and position. Lastly, we engage in several

[15] We also checked for "value effects", i.e., whether an alternative with higher value, ceteris paribus, is selected more often than an alternative with lower value (see further details on Section 4 below).

standard regression analyses to control for individual characteristics and thus, to test for the robustness of previous results. The regression analysis allows us to improve our understanding of how the searching process determines the response, as well as highlights which type of individuals are more sensitive to social influence. The statistical significance for independent samples is measured using one-tailed non-parametric Mann-Whitney (M-W) statistics unless stated otherwise. In line with our hypotheses, we focus on the alternative selected first (as the preferred one). From now on, and unless stated otherwise, we pool the data from the sessions where the text task was performed first and those sessions where it was performed following the calculus task. In order to ensure that we can pool data from those treatments, we run a Mann-Whitney test for each treatment for the variables "alternative opened first" and "alternative chosen as first". Differences are never significant (minimum p=0.201, two-tails) except for the choice variable in T_H (p=0.003, one-tail). Thus, it might just affect results regarding Hypotheses 2. We address this issue below in Section 4.2.[16]

4.1 Summary Statistics

In Figure 2, we report the descriptive statistics (i.e., means and confidence intervals at a 95% level) of participants' decisions for the no-social influence and social influence treatments (top and bottom graphs, respectively). In particular, in the left histograms (a and c) of the figure, we compute the frequency with which each of the three positions displayed on the computer screen (A, B and C) was opened first (Opening) for all treatments. It is clear that almost all subjects in all treatments opened A first, that is, the alternative in the first position in the screen. Nevertheless, in the treatments where popularity went in a different direction to the position order (T_M⋆ and T_H⋆⋆), the frequency decreased significantly compared to the case where social influence was not present (T_M and T_H) or aligned with position (T_M⋆⋆⋆ and T_H⋆⋆⋆) (maximum p-value=0.001 for T_M⋆ vs. T_M, T_H or T_M⋆⋆⋆); maximum p-value=0.034 for T_H⋆⋆ vs. (T_M, T_H or T_H⋆⋆⋆). Regarding the alternative opened first according to its popularity (⋆⋆⋆, ⋆⋆, ⋆), it can be observed that there is more heterogeneity in behavior in those treatments in which position is not aligned with popularity (i.e., T_M⋆

[16] In the matrix task, all treatments except for T_H and T_H**, present significant differences in the choice decisions between performing the matrix task first and second. This is an additional reason to focus on the text task.

and T_H⋆⋆). Notice that when the alternative is displayed in the first position (A), the higher its popularity, the higher the probability of opening it first (see the four histograms in panel c of Figure 2). However, the alternative with three stars was rarely opened first when it was not in the first position (see alternative in position B in T_M⋆). Thus, it seems from the descriptives that the popularity of the alternatives does not play a relevant role in the opening decision, whereas position still does. This finding will be formally tested in the next section.

Here Figure 2

With respect to the alternative chosen as first (choice), the histograms in the right part of Figure 2 display the results from the position perspective (A, B, C) for all treatments. In the treatments where popularity is not present, the alternative in the first position, A, is the most frequently chosen as first, although the frequency has considerably decreased with respect to the opening decisions.[17] As expected, when social influence reinforces the position order (T_M⋆⋆⋆ and T_H⋆⋆⋆), results hold or are even stronger (than in T_M and T_H) for the position effects (i.e., for choosing alternative A).[18] Nevertheless, when popularity goes in a different direction (T_M⋆ and T_H⋆⋆), the frequency of the alternative A drops by at least 40% for both presentation orders (O_1 and O_2).[19] When the observed order is O_1 (T_M⋆), it seems that the dominant criterion to select the first option is popularity (stars), since the alternative with three stars is much more frequently chosen than the other two (p-value=0.001 for ⋆⋆⋆ vs. ⋆⋆ , p-value=0.010 for ⋆⋆⋆ vs. ⋆, in T_M⋆). This is not the case when O_2 (T_H⋆⋆) is observed. In this case, it seems that the conflict between position and social influence has no clear winner, since the alternatives with three and two stars are selected with almost the same frequency.[20] A possible explanation may be that in O_1, the alternative with three stars is also the one with the highest value, while in O_2, the alternative with two stars has a higher value than the one with three stars. In summary, popularity seems to play a prominent role driving subject's choice, but position is still relevant when

[17] p-value<0.001 for both T_M and T_H.
[18] p-value=0.045 for T_M vs. T_M***, p-value=0.243 (two-tailed test) for T_H vs. T_H***.
[19] p-value<0.001 for T_M*** vs. T_M*, p-value=0.001 for T_H vs. T_H**.
[20] p-value=0.768 for ⋆⋆⋆ vs. ⋆⋆, in T_H**; two-tailed test.

social influence is not present.[21] Notice that in Figure 2, we abstract from the value associated with each alternative, which will be taken into account in the analysis below.[22]

In addition, Figure 2 shows that the effect on the opening behavior of an increase in position from the second to the first position is much larger than an increase from the third to the second position (which is barely inexistent). This also happens for the choice behavior when we compare the effect of an increase of one star from two to three stars or from one to two stars. This suggests that both position and social influence effects are not linear.

We also computed the summary statistics for the third option opened and chosen and find similar results to the ones commented on above (see Table F1 in Appendix F). First, the alternative in the third position is almost always opened in the third place (or not opened at all) and it is very frequently chosen last (especially in the treatments without social influence). Second, the least popular alternative (the one with one star) is the most frequently selected as third in the reply vector.

Finally, we comment on the time devoted to each alternative. As mentioned above individuals spent most of the time analyzing the alternative opened first which was almost always the one in the first position. Moreover, we find that as the time spent analyzing the alternative in the first position increases, the probability of choosing it as first increases as well (there is a significant correlation of 23% in the social influence treatments). Interestingly, there is no significant correlation for those alternatives in the second and third position.

In the next subsection, we describe social influence and position effects in a systematic way, formally testing the hypothesis described in Section 3.

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[21] To complement the description of individual behavior presented in Figure 2, we provide additional preliminary evidence of social influence and position effects aggregating across treatments in Figure D1 in Appendix D.

[22] We find similar results in the descriptive statistics of the matrix task (see Table E1 in Appendix E). Nevertheless, we find some inconsistencies while analyzing some descriptive for the choice behavior. For instance, in T_H** the alternative with three stars is the one less frequently chosen as first (just 2% of the time) although it has the highest value (H) and is in the second position. Therefore, these decisions cannot be explained by popularity, position or value of the alternative. For other similar incongruities see Appendix E. Observe that none of these inconsistencies are found in the text task.

4.2 Social Influence and Position effects

In this section, we follow the formulation of the hypotheses described in Section 3. Recall that, in order to test for social influence effects formally, we compare alternatives that are equal in all components except for their popularity. For example, as illustrated in column (2), Table 1 below, alternative (H, A, ⋆⋆⋆) is opened first with a frequency of 94%, whereas alternative (H, A, ⋆⋆), which only differs from the former alternative in its popularity, is opened first with a frequency of 83% as illustrated in column (5). Such a drop of 11% (see column (7)) is significant at a 1% level ($p<0.001$). If we compare the same two alternatives but with respect to the frequency of final choices, we observe a drop of 29% for the alternative with lower popularity (see column (8) in Table 1), which is also highly significant.

Here Table 1

Overall, there are strong popularity effects in four out of the six possible tests described both in the choice and opening behavior. We thus claim the following:

Result 1: *(H1) There are social influence (popularity) effects both in the opening and the choice behavior.*

We analyze position effects next. Note that we can do so by evaluating them in isolation or in the presence of social influence (i.e., using the no-social influence or social influence treatments, respectively). Recall that, in order to formally test for position effects, we compare alternatives that are equal in all components except for their position. As illustrated in Table 2, position effects are strongly significant with and without social influence for opening and choice. For example, column (3) shows that alternative (H,A) is chosen as first with a frequency of 66%, whereas alternative (H,B), which only differs from the former alternative in its position, is chosen as first with a frequency of 38% (see column (6)). Such a drop of 28% (column (8)) is significant at the 1% level.

Here Table 2

Notice that there are strong position effects in two out of the three possible tests in the no-social influence treatments and in four out of the six possible tests in the social influence treatments, both for the opening and the choice behavior. We therefore claim the following:[23]

Result 2: *(H2) There are position effects both in the opening and the choice behavior.*

Next, we compare position and social influence effects by analyzing the results from treatments where the popularity goes in a different direction than the position, that is, T_M⋆ and T_H⋆⋆. In these treatments, subjects experience stronger cognitive dissonance due to this lack of consistency between the presentation order and the popularity ranking (see Festinger, 1957). Recall that in order to test which effect is stronger, we compare alternatives with a higher position than popularity with alternatives with the reverse characteristics. As illustrated in Table 3 below, position effects are stronger than social influence effects for the opening behavior, whereas the reverse is true (although not always significant) for the choice behavior.

Here Table 3

For example, column (2) in Table 3 below shows that alternative (H,B,⋆⋆⋆) is opened first with a frequency of 27%, whereas alternative (H,A,⋆⋆), which has a higher position but lower popularity than the former alternative, is opened first with a frequency of 83% (column (5)). Such an increase of 56% (column (7)) is significant at the 1% level. In this case, therefore, position effects are more relevant than social influence effects in the opening behavior. Nevertheless, column (3) shows that alternative (M,C,⋆⋆⋆) is chosen as first with a frequency of 43%, whereas alternative (M,A,⋆) is chosen as first with a frequency of 26% (column (6)), which implies that in this case social influence effects are significantly larger (at a 5% level) than position effects in the choice behavior. We thus claim the following:

[23] In Table G1 in Appendix G we check Hypotheses 2 for the “Choice” behavior distinguishing sessions where the text task was performed before the calculus task with those where it was performed after it.

Result 3: *Position effects are stronger than social influence effects for the opening behavior (H3' holds), but social influence effects are stronger than position effects for the choice behavior (H3 holds, but weakly).*

To summarize, the results in this section provide evidence of social influence effects on behavior, an aspect of human nature that has already been documented in previous studies. A novel feature of our approach, however, is that we can disentangle social influence from position effects both in the searching and choice behavior. Our findings show that position is more relevant in terms of searching behavior, but less important for predicting actual choice, which depends more strongly on social influence.[24]

In what follows, we use a regression model to analyze influenceability at an individual level, which is another contribution to the related literature. We also use this approach to provide a robustness check of our previous findings and to better understand the interaction between the individuals' searching process and their final decision.

4.3 Individual influenceability

We now conduct a regression analysis to study some determinants of social influence and position effects on individual decisions (both in "opening" and "choice"). In what follows, we focus on the treatments with social influence (i.e., T_M⋆⋆⋆, T_H⋆⋆⋆, T_M⋆ and T_H⋆⋆) since they are the only ones which allow us to compare popularity and position effects. For simplicity, we define individual influenceability as the probability of opening/choosing first the most popular (three stars) alternative. We also define position sensitivity as the probability of opening/choosing first the alternative in the first position (A). That is, a characteristic is a determinant of individual influenceability (or position sensitivity) if the likelihood of opening/choosing the most popular alternative (or the alternative in the first position) is higher for individuals with such a characteristic.[25] In addition, we analyze whether the probability of

[24] We find similar results when we conduct the tests for Hypothesis H1 to H3 for the matrix task (see Table E2 in Appendix E). See Table G2 for results on the existence of Value effects mentioned above.
[25] We check the robustness of results by considering a probit model. Our findings, available upon request, are qualitatively the same as the ones presented here. See Angrist and Pischke (2009) for a discussion of what a "right" model is between linear probability models (LPM) and probit or logit ones.

opening/choosing first the alternative in the first position (respectively, the most popular one) due to a one-star increase (respectively increase in one position) is larger among individuals with some specific characteristic. To do so, we estimate several extended models where we interact each of the control variables with the corresponding treatment variable (either Position of ⋆⋆⋆ or Popularity of A). This allows us to gauge how influence interacts with individuals' characteristics to affect choices.

We examine whether socio-demographic status (SDS) and non-SDS correlates to both individual influenceability and position sensitivity by estimating a linear regression where the dependent variable is the probability of opening/choosing first the most popular (three stars) alternative and the alternative in the first position (A), respectively. We include as explanatory variables a set of individual characteristics, all of them collected from a questionnaire at the end of the experiment as described above, except for ability, which was retrieved from the trial rounds. Among the SDS variables, we focus on the Female dummy and Wealthy family. To ease the interpretation of the quantitative effect associated with each coefficient, and facilitate the heterogeneity analysis below, we collapse some variables into dummy variables. For instance, Wealthy family is a dummy with a value of 1 if the estimated income of an individual was above the 75th percentile.[26] Among the non-SDS measures, we consider Ability, which measures the performance of the subject in the trial rounds capturing both distance to correct answer and time to complete it; Risk averse, which is a categorical variable equal to 3 for subjects claiming they would invest 5 Euros or less in the risky option, equal to 2 for subjects claiming they would invest between 6 and 9 Euros and equal to 1 for subjects claiming they would invest 10 Euros in the risky option; Overconfident, which is a dummy with a value of 1 if a subject erroneously thinks that her performance in the task was above or on average; Reflective, which is a categorical variable equal to 2 if the number of correct answers in the CRT test is above 1, it is equal to 1 if the number of correct answers in the CRT test is equal to 1 and 0 if the number of correct answers in the CRT test is equal to 0 and Arrogant, which is a dummy with a value of 1 if a subject claims it is hard for her to recognize her own mistakes (see Appendix B for further details on the definitions of these variables). We also include several treatment variables: Position of ⋆⋆⋆, Popularity of A and Value of

[26] We tested the robustness of results to alternative definitions of Wealthy Family. We also control for other SDS variables such as Age, and Business, which is equal to 1 for those subjects taking business-related studies in their undergraduate programs.

⋆⋆⋆ (or A), which accounts for the position of the most popular alternative (that is, 1 for C, 2 for B and 3 for A), the number of stars of the alternative in the position A (that is, from 1 to 3) and value of the most popular alternative or the one in the first position, when it corresponds (which is a dummy equal to 1 when the value of the alternative is H). Lastly, we included Text First, which is a dummy with a value of 1 if a subject performed the text task before the calculus task in the experiment.

4.3.1 Opening behavior

Tables 4 and 5 show the results for the individual's influenceability and sensitivity to position in the opening behavior. Table 4 presents the estimated regression coefficients where the dependent variable is the probability of opening first the most popular alternative (three stars). Therefore, these estimates represent correlates of individual influenceability. Table 5 presents the estimated regression coefficients where the dependent variable is the probability of opening first the alternative in the first position (A). This regression shows correlates of position sensitivity. In column (1) of both Tables 4 and 5 we consider all sets of controls SDS and non-SDS variables. In columns (2) to (8) we interact each of the control variables with the corresponding treatment variable (either Position of ⋆⋆⋆ in Table 4 or Popularity of A in Table 5).

Here Table 4

Several results can be found in Tables 4 and 5. First, interestingly, overconfidence turns out to be significant, while all other individual characteristics are clearly insignificant. In particular, we find that overconfident subjects are more likely to open first the most popular alternative. In other words, being overconfident is a characteristic that correlates with individual influenceability in searching behavior. This result is robust to the consideration of different specifications (see columns 1 to 7). The size of the effect is quite large (about 0.2) compared to the average value of the proportion of individuals opening as first the most popular alternative, 0.6 (see Table F1 in Appendix F). That is, the overconfident individuals open the most popular alternative 20% more frequently than the non-confident ones. Thus, our results contradict previous findings in the literature (see, for instance, Hoppitt and Laland, 2013 mentioned above), which suggests that for individuals who lack confidence, following others is a quick solution.

Here Table 5

This result is confirmed in column 8 in Table 5. As can be observed there, overconfident individuals, who open the alternative in position A less frequently than non-overconfident ones, are more prone to open it first as its popularity increases (see the coefficient of Overconfident * Pop in column (8)).

A possible explanation for this could be related to the so-called Krueger-Dunning effect. According to this effect, individuals' overestimation of ability in social and intellectual domains occurs, in part, because people who are unskilled in these domains suffer a dual burden: not only do these people reach erroneous conclusions and make unfortunate choices, but their incompetence robs them of the meta-cognitive ability to realize it (see Krueger and Dunning, 1999). Indeed, in our setting, overconfident subjects have well below-average ability. It is thus possible that these individuals follow what others have done because they lack knowledge of the correct answer. To summarize, we announce the following result:

Result 4: *Overconfident subjects are more influenceable than non-overconfident ones in the opening behavior.*

The low variability in the individual opening behavior, 86% of subjects opened first the alternative in the first position and 58% the most popular alternative (see Table B.1 in Appendix B), might explain why none of the other individual variables turn out to be significant in explaining individual influenceability and position sensitivity in this case.

Lastly, we comment on whether previous hypotheses H1 to H3′ hold after controlling for individual characteristics (and using observations in social influence treatments). First, regarding Hypothesis 1, observe that there are popularity effects in the opening behavior (see the coefficients of Popularity of A in Table 5). In particular, we find that an increase of one star in the popularity of alternative A increases the probability of individuals opening it first between 7% and 18% on average (see row 1 in Table 5). Second, with respect to Hypothesis 2 notice that there are position effects (see the coefficients of Position of ⋆⋆⋆ in Table 4). In particular, we find that an increase in one position of the most popular alternative increases the probability of individuals opening it first by about 37%-45% on average (see row 1 in Table 4). Therefore, and after comparing the coefficients of Position of ⋆⋆⋆ and Popularity of A, we can conclude that position seems more relevant than popularity for the opening behavior, in line with the results mentioned above regarding Hypothesis 3′ (the difference is statistically significant, p<0.0001).

4.3.2 Choice behavior

Tables 6 and 7 show the results for individual influenceability and sensitivity to position in the choice behavior. Table 6 presents the estimated regression coefficients, where the dependent variable is the probability of choosing first the most popular alternative. In Table 7 the dependent variable is the probability of choosing first the alternative in the first position (A). Estimates in these two tables, thus, represent correlates of individual influenceability and position sensitivity in the choice decision, respectively. In line with the hypotheses we have tested previously, in addition to Position of ⋆⋆⋆ and Popularity of A, we also include a dummy variable equal to one when the value of the alternative chosen first is also the one with the highest value (H), Value. This variable is not included in the regression regarding the opening behavior, as agents cannot infer the value of an alternative before opening it. In addition, we also consider as an explanatory variable the individual opening behavior to identify whether it affects the final choice. In particular, we consider the variable Open 1st, which is a dummy equal to 1 if the individual opened first the alternative in the first position or the most popular one when it corresponds.[27]

Here Table 6

Several results can be found in Tables 6 and 7. Observe from Table 6 that overconfident subjects are more likely to choose most popular alternative as their first option. In other words, being overconfident is a characteristic that correlates with individual influenceability not only in opening but also in choice behavior:[28]

[27] Observe that the individual opening behavior might not be an exogenous variable in this regression. To account for possible endogeneity problems in this variable, we estimate the effect of the opening behavior on response behavior following an Instrumental Variable approach. Results using this methodology can be found in Table H1 in Appendix H. As can be observed, the results are qualitatively the same as the ones provided above.

[28] Results 4 and 5 are robust to several checks, for instance by estimating the model in Column 1 of Tables 5 and 7 again, excluding subjects from one session at a time (to check that our results are not driven by one specific session). Similar results were also found by computing marginal effects from probit/logit estimations.

Result 5: *Overconfident subjects are more influenceable than non-overconfident ones in the choice behavior.*

Here Table 7

Table 7 shows that wealthier subjects are less likely to select as first the alternative in the first position.[29] A possible explanation could be that individuals from wealthier families are endowed with non-cognitive abilities (Cunha and Heckman, 2007), such as desire for control or locus of control (that is, individuals who prefer to have control over the events in their lives), which are negatively associated with being easily influenced by others (Nezlek and Smith, 2017). In addition, those subjects who do not recognize their mistakes are also less prone to choose as first the alternative in the first position. This finding can also be observed in column 5 in Table 6. As is shown there, arrogant individuals are more prone to choose first the most popular alternative but react less to an increase in its position (see the coefficient of Arrogant*Pos in column (5)). This result confirms previous findings in the related literature (Leary et al. 2017).

Similar to arrogant individuals, reflective individuals are more prone to select as first the most popular alternative but react less to an increase in its position (see column 6 in Table 6). This result seems to contradict previous evidence (which finds that more reflective individuals would be less influenceable). However, our finding might be explained by the fact that reflective individuals believe more firmly in the wisdom of the crowd.[30]

Result 6: *Wealthier and arrogant individuals are less sensitive to position in the choice decisions. A similar but weaker effect is found for reflective individuals.*

Evidence abounds that individuals exhibit risk-averse behavior even for a decision-making process in laboratory experiments (see, among others, Holt and Laury, 2002). However, as explained above, whether risk aversion increases or decreases influenceable behavior is theoretically ambiguous, as following the "popular option"

[29] Results remain after considering alternative definitions of Wealthy Family, for instance, choosing a lower or higher percentile as a threshold.

[30] See previous comments on the different types of social influence (i.e., normative vs informative) in the Introduction.

might entail ambivalent amounts of risk. Finding that risk aversion plays no significant role in the final choice might be due to the fact that different effects are taking place simultaneously and thus they cancel each other out.

Notice that the order of opening of the most popular alternative has no impact in the choice decision (see variable Open 1st *** on Table 6). However, the order of opening of the alternative in the first position increases the probability of choosing it (see variable Open 1st A). This finding is quite natural; individuals tend to choose alternative A only when it has been analyzed more thoroughly (opened first and most time devoted), but they choose the most popular alternative regardless of whether or not it has been analyzed carefully.

Result 7: *Opening first the alternative in the first position increases the likelihood of choosing this alternative, whereas the likelihood of choosing the most popular alternative does not depend on the opening behavior.*

We comment now on whether previous hypotheses H1 to H3′ hold in the choice decision after controlling for individual characteristics (and using observations in T_M⋆ and T_H⋆⋆). First, regarding Hypothesis 1, observe that there are popularity effects in the choice behavior (see the coefficients of Popularity of A in Table 7). In particular, we find that an increase of one star in the popularity of alternative A increases the probability of individuals selecting it as first by about 15-24% on average. Interestingly, and opposite to Ursu (2018), this effect does not vanish even when we control for opening behavior, as we do here. Hence, the popularity of an alternative affects the choice decision not only through the opening behavior (as shown in Table 5 above), but it has an additional independent effect.[31] A plausible explanation of that finding might be related to our measure of the individual's searching behavior, which considers not only clicking (opening), as Ursu (2018) and most related studies do, but the order of clicking. In particular, we find that it is the fact of being opened first which affects choice whereas being just opened has not impact on individuals' final decision. We can show that if we consider this less precise measure of individuals' searching behavior, final choices related to being opened first may be incorrectly attributed to the popularity

[31] The estimated coefficients of the variables Open 1 st A and Popularity of A are not statistically different in any model (minimum p-value =0.3675, two tails).

or position of the alternative, thus biasing the results.[32] Second, with respect to Hypothesis 2, notice that there are very weak position effects in the choice behavior for the most popular alternative since there are some coefficients of Position of ⋆⋆⋆ which are insignificant and only 3 weakly significant. Moreover, after comparing the coefficients of Position of ⋆⋆⋆ and Popularity of A (the difference is statistically significant, p=0.0379), we can conclude that popularity seems more relevant than position for the choice behavior, in line with the results mentioned above regarding Hypothesis 3. In summary,

Result 8: *Social influence effects are larger than position effects in the final choice via its impact in the two phases of the decision process (search and final choice).*

Notice that, the popularity of the top positioned alternative (A) significantly affects its choice. It does so via the two phases of the decision process with similar size impact on each of them: popularity directly affects the final choice (regardless of the search behavior) and it indirectly influences choice through the searching behavior which, in turn, also affects positively the final decision.

Regarding the explanatory variable Text first, we find that it is never significant for either the opening or the response behavior, confirming the results obtained in previous tests (see the introductory paragraph in the results section).[33]

Finally, we considered the third alternative (opened third and positioned the last one in the choice ranking) and also checked whether Hypotheses 1 to H3′ hold after controlling for individual characteristics. We find that the main results of the paper are robust to the analysis of the third alternative: there are social influence and position effects. That is, an increase in the popularity/position of an alternative reduces the probability of opening/choosing it as third. In addition, again, whereas position effects

[32] We estimate again the models in Tables 6 and 7 using a different measure of individual's search behavior. Namely, we consider Open *** or A, which is a dummy which takes value one when the most popular alternative (Table 6) or that one in the first position A (Table 7) is opened regardless of the order in which it was opened. We found that Open (*** or A) does not affect the choice of the most popular alternative (***) nor the one in the first position, A. In addition, we observe that these models fit worse the data (R^2 are always lower). Finally, the estimated impact of the popularity or position of the alternative on its final choice is larger now (i.e. it is upward biased). These results are available upon request.

[33] This is not the case for the matrix task on the choice behavior. In line with the incongruities observed in the descriptive statistics, we find that when the alternative (in the first position with three stars) has the highest value, there is a decrease in the probability of choosing it (see the coefficient of variable "value H" in Tables E3 and E4 in Appendix E).

are stronger in the opening behavior, social influence effects dominate position effects in the final choice. Results are available upon request.

5. Conclusion and discussion

Social influence has attracted increasing attention in the literature on economics. The fact that the mere perception of other people's choices influences ones' decision, is relevant for understanding a wide range of socioeconomic phenomena and can lead to important policy implications (e.g., launching an informational campaign about the popularity of a new technology). This paper complements the existing literature by describing a laboratory experiment to quantify and disentangle the effects of social influence from purely framing effects in a highly controlled context.

We find that, in line with online marketing studies, in the absence of information about the popularity of alternatives, the presentation order significantly induces choices, mainly because individuals tend to select the alternatives that have been carefully analyzed, and this is highly correlated with their position. This helps explain the importance of the default rankings even when they follow an unknown criterion (for instance, Amazon where the default order is referred to as the "prominent" options). Individuals still might infer some objective and external validation of such rankings that conditions their behavior.[34]

When information about popularity is explicitly shown, we find that the position has a great impact in searching behavior but minor for predicting the final choice, as this effect is surpassed by that of social influence. Our description of how agents search is more precise than that used in related studies (e.g., Ghose et al.,2014 or Ursu, 2018) since we consider the order of search and the time devoted to each alternative. If these findings were extrapolated to online markets, we would suggest the following strategy to the firm: if its product is among the most popular ones, the firm might not need to invest in its positioning. Otherwise, placing the product in a top position is of crucial importance not only because it will be assessed first, but also because more time will be devoted to it.

[34] This may be like a self-fulfilling prophecy by which someone predicting or expecting something, induces through her behavior this prediction which eventually fulfills her initial beliefs.

The results of our study also suggest that position effects and social influence effects are not linear. For instance, an increase from the second ranked alternative to the first, regarding both position or popularity, has a much larger impact on choices than an increase from the third ranked alternative to the second. This may have straightforward policy implications for how worthy the cost of increasing the top positions should be compared to those in intermediate or low positions.

Discovering which individual characteristics are associated with influenceability could be useful in order to construct optimal personalized rankings targeted to specific groups of individuals. In this respect, we show that, contrary to what one would have expected, overconfident individuals are more susceptible to social influence both for the searching behavior and the actual choice. Testing whether this result is robust to other, less artificial, settings is a natural extension of this work.

Our laboratory experiment highlights the importance to measure *the order* of search and not only whether a product/service was searched to understand consumers' decisions. In addition, it would be interesting for further field experiments or online intermediaries' platforms to collect the time devoted to assess a product/service.

A potential advantage of our approach is that it could lead to an appropriate way of measuring the deadweight loss driven from social influence. Nevertheless, our experiment, as it is, was not designed for asking such question. Note that theoretically there should be no profit loss since expected payments are the same with the two presentation orders proposed. That is, if we assume for simplicity that participants somehow follow the presentation order in the treatments without social influence whereas, they follow popularity in the social influence ones, the expected payoffs should be the same, since regardless of the treatment subjects would be choosing one of the proposed orders. This conjecture is confirmed in our framework by the corresponding tests between average payoffs of treatments with and without social influence (minimum p-value = 0.583, two tails). Therefore, we do not find any evidence of deadweight loss driven by the social influence. Nevertheless, this feature could be worthwhile studying in a similar setting but with a different payoff structure.

There are several other directions in which our study could be extended. First, one could further investigate the connection between complexity and social influence by varying several aspects of our design. For instance, by modifying the time constraints provided to individuals we could either complicate or simplify their decision process. Also, in our case subjects are aware of the existence of all three possible alternatives even without engaging in any search and thus, it is left for further research to study whether our findings extend to situations where individuals have more time, but more alternatives as well. Moreover, we have considered a one-shot decision, but the question remains as to how individual influenceability will evolve with experience. Second, we have focused on a rather homogeneous population (i.e., students from a Spanish university), but it would be interesting to increase the sample to account for larger differences in individual characteristics, in order to consider a wider spectrum of ages, professions, nationalities and religions. Following this idea, one could relax the anonymity of the social signal by providing information about the characteristics of those being observed, as this could explain whether individuals are more easily influenced by other individuals who are similar to themselves or not.

References

Agarwal, A., Hosanagar, K., Smith, M., 2011. Location, location, location: Analysis of profitability of position in online advertising markets. *Journal of Marketing Research* 48, 1057-73.

Angrist, J. D., Pischke, J., 2009. Mostly harmless econometrics: An empiricist's companion. *Princeton University Press*.

Asch S. E., 1953. Effects of Group Pressure Upon the Modification and Distortion of Judgments. D. Cartwrights and A. Zander, *Group Dynamics: Research and Theory*. Row, Peterson and Co. 151-62.

Blake, T., Nosko C., Tadelis, S., 2015. Consumer heterogeneity and paid search effectiveness: A large scale field experiment. *Econometrica* 85, 155-74.

Bordalo, P. Gennaioli, N. and A. Shleifer, 2013. Salience and Consumer Choice, *Journal of Political Economy*, 121(5), 803 - 843

Bougheas, S., Nieboer, J., Sefton, M., 2013. Risk-taking in social settings: Group and peer effects. *Journal of Economic Behavior & Organization* 92, 273-83.

Brandts, J., Giritligil, A. E., Weber, R. A., 2015. An experimental study of persuasion bias and social influence in networks. *European Economic Review* 80, 214-29.

Brañas-Garza, P., Jorrat, D., Espín, A.,Sanchez, A., 2020. Paid and hypothetical time preferences are the same: Lab, field and online evidence. *Mimeo*

Cai H., Chen Y., Fang H., 2009. Observational Learning: Evidence from a Randomized Natural Field Experiment. *American Economic Review* 99, 864-82.

Carlin, B.I. and F. Ederer, 2019. Search Fatigue. *Review of Industrial Organization*, 54(3), 485-508.

Charness G., Gneezy U., Imas A., 2013. Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior & Organization* 87, 43-51.

Cialdini R. B., 2006. Influence: The Psychology of Persuasion. *Collins Business Essentials, Harper Collins, USA.*

Cross, C. P., Brown, G. R., Morgan, T. J. H., Laland, K. N., 2017. Sex differences in confidence influence patterns of conformity. *British Journal of Psychology* 108, 655-67.

Cunha, F., Heckman, J. J., 2007. The Technology of Skill Formation. *American Economic Review* 97, 31-47.

De los Santos, B., Koulayev, S., 2017. Optimizing click-through in online rankings with endogenous search refinement. *Marketing Science* 36, 542-564.

Dijksterhuis A., Bos M.W., Nordgren L. F., van Baaren R. B., 2006. On Making the Right Choice: The Deliberation-Without-Attention Effect. *Science*, 311 (5763), 1005-7.

Fatás E., Hargreaves Heap S.P., Rojo Arjona D., 2018. Preference Conformism: An experiment. *European Economic Review* 105, 71-82.

Festinger, L., 1957. A theory of cognitive dissonance. Palo Alto, CA, US: *Stanford University Press.*

Festinger L., Schachter S., Back K., 1950. Social Pressures in Informal Groups. *Harper, New York.*

Fischbacher, U., 2007. z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics* 10, 171-8.

Fransen, M L., Fennis, B M., 2014, Comparing the Impact of Explicit and Implicit Resistance Induction Strategies on Message Persuasiveness, *Journal of Communication* 64, 915-34.

Frederick S., 2005. Cognitive Reflection and Decision Making. *Journal of Economic Perspectives* 19, 25-42.

Ghose, A., Ipeirotis, P. G., Li, B., 2014. Examining the Impact of Ranking on Consumer Behavior and Search Engine Revenue. *Management Science* 60, 1632-54.

Gneezy U., Potters J., 1997. An Experiment on Risk Taking and Evaluation Periods. *The Quarterly Journal of Economics* 112, 631-45.

Goeree, J. K., Yariv L., 2015. Conformity in the Lab. *The Journal of the Economic Science Association* 1, 15-28.

Greiner B., 2004. The Online Recruitment System ORSEE 2.0 - A Guide for the Organization of Experiments in Economics. *University of Cologne WP Series in Economics 10.*

Holt, C. A., Laury, S. K., 2002. Risk aversion and incentive effects. *American Economic Review* 92,1644-55.

Hogg, T., Lerman, K., 2015. Disentangling the effects of social signals. *Human Computations* 2, 189-208.

Hoppitt W., Laland K.N., 2013. Social learning: an introduction to mechanisms, methods, and models. *Princeton, NJ: Princeton University Press*.

Hortas-Rico M., Onrubia J., 2014. Renta personal de los municipios españoles y su distribución: Metodología de estimación a partir de microdatos tributarios. *Estudios sobre la Economía Española*, 2014/12, FEDEA.

Jindal P., Aribarg, A., 2020. The importance of price beliefs in consumer search. Mimeo.

Kemeny J., 1959. Mathematics without numbers. *Daedalus* 88, 577-91.

Kocher M. G., Sutter M., 2006. Time is money: Time pressure, incentives and the quality of decision-making. *Journal of Economic Behavior & Organization* 61, 375-92.

Kruger, J., Dunning, D., 1999. Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology* 77, 1121-34.

Laland K.N., 2004. Social learning strategies. *Learning Behavior* 32, 4-14.

Leary M. R., Diebels K. J., Davisson E. K., Jongman-Sereno K. P., Isherwood J. C., Raimi K. T., 2017. Cognitive and interpersonal features of intellectual humility. *Personality and Social Psychology Bulletin* 43, 793-813.

López-Pintado D., Watts D. J., 2008. Social influence, binary decisions and collective dynamics. *Rationality and Society* 20, 399-443.

Manolis, C., Roberts, J. A., 2012. Subjective Well-Being among adolescent consumers: the effects of materialism, compulsive buying, and time. *Applied Research in Quality of Life* 7, 117-35.

Manski C. F., 1993. Identification of endogenous social effects: the reflection problem. *The Review of Economic Studies* 60, 531-42.

Mavrodiev P., Tessone C.J., Schweitzer F., 2013. Quantifying the effects of social influence. *Scientific Reports* 3, 1360.

Moreno B., Ramos-Sosa M.P., Rodriguez-Lara I., 2019. Conformity and truthful voting under different voting rules. *ThE Papers 19/04, Department of Economic Theory and Economic History of the University of Granada*.

Muchnik L., Aral S., Taylor S. J., 2013. Social Influence Bias: A Randomized Experiment. *Science* 341, 647-51.

Nezlek, J. B., Smith, C., 2017. Social Influence and Personality in The Oxford Handbook of Social Influence, S. G. Harkins, K. D. Williams, and J. Burger (Eds) *Oxford University Press, New York.*

Salganick M. J., Dodds P. S., Watts D. J., 2006. Experimental Study of the Inequality and Unpredictability of an Artificial Cultural Market. *Science* 311, 854-56.

Schwartzstein, J. 2014. Selective Attention and Learning, *Journal of the European Economic Association*, 12(6), 1423-1452.

Shurchkov O., 2012. Under Pressure: Gender Differences in Output Quality and Quantity under Competition and Time Constraints. *Journal of the European Economic Association* 10, 1189-213.

Sternberg R. J., Forsythe G., Hedlund J. A., Horvath R., Wagner R. K., Williams W., Snook S. A., Grigorenko E., 2000. Practical Intelligence in Everyday Life. *New York, NY,Cambridge University Press.*

Ursu R. M., 2018. The Power of Rankings: Quantifying the Effects of Ranking on Online Consumer Search and Purchase Decisions. *Marketing Science* 37, 507-684.

Van Loo, E., Caputo, V., Jr., Nayga, R. M., Seo, H.-S., Zhang, B., Verbeke, W., 2015. Sustainability labels on coffee: Consumer preferences, willingness-to-pay and visual attention to attributes. *Ecological Economics* 118, 215-25.

Watts D. J., 2007. A twenty-first century science. *Nature* 445, 489.

Williams, E.J., Beardmore, A., Joinson, A., 2017. Individual differences in susceptibility to online influence: a theoretical review. *Computers in Human Behavior* 72, 412-21.