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On the reliability of the foreign language effect on risk-taking

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Abstract

People consider choices that involve risk on a daily basis. In principle, willingness to take risks should be independent of the language used while considering the available options. However, research has shown that using a foreign language can increase willingness to take risks, presumably because a foreign language is less emotional. Here, we investigate the robustness of this effect of language on risk by varying participant language background and methodological design features. In addition, we investigate whether using a foreign language increases risk-seeking behaviour in general, or whether it promotes a more strategic approach to risk. Four experiments reveal mixed results regarding the effect that using a foreign language has on risk-taking. Experiment 1 clearly shows that using a foreign language increases strategic risk-taking compared with using a native tongue. In contrast, Experiments 2 and 3 find no effect of the native-ness of language on risk-taking. Experiment 4 supports the idea that using a foreign language promotes risk-taking in general compared with using a native language. We discuss these mixed results in the context of previous findings and suggest potential directions for future research to clarify the effect of language on risk-taking.

Keywords

Bilingualism; decision making; emotion; foreign language; risk; loss aversion

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Introduction

Many daily activities involve some degree of risk, from driving to work to investing in the stock market. However, despite extensive experience with risk, we do not seem to manage it optimally, even in our domain of expertise (e.g., Haigh & List, 2005). Sometimes we play it too safe and miss out on a good opportunity (e.g., Rabin & Thaler, 2001; Shiv, Lowenstein, Bechara, Damasio, & Damasio, 2005). Other times we take risks when we should have walked away. This is especially the case when walking away entails accepting a loss—we hate the idea of a sure loss and often risk losing even more in an attempt to avoid it (Kahneman & Tversky, 1979). Such emotional reactions may be in conflict with our more reflective cost–benefit calculations (Kahneman, 2003). Here, we explore a factor that may affect how we make risky choices—the use of a foreign language. Although a native language triggers emotional reactions that can lead to suboptimal decisions, using a more emotionally distant foreign tongue could lead to more strategic risk-taking.

Using a foreign language is less emotional than using a native tongue (e.g., Pavlenko, 2005). For instance, people are less physiologically aroused when listening to taboo words and reprimands in a foreign language (Harris, Aycicegi, & Gleason, 2003). This reduction in emotionality could be the reason for a surprising increase in willingness to take risks. Keysar, Hayakawa and An (2012) found that those using a foreign language were more likely to accept advantageous bets than those using a native tongue.

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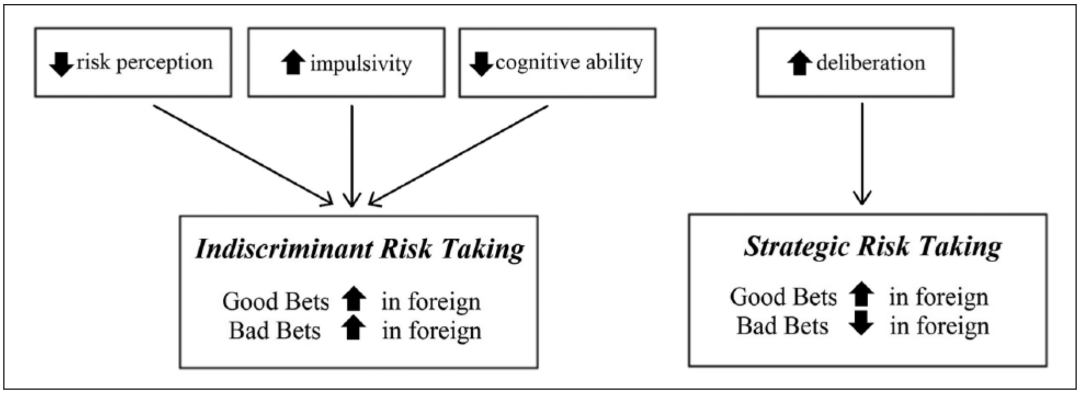

Figure 1. Process paths resulting in either indiscriminant or strategic risk-taking when using a foreign language.

Participants made 15 decisions in either their native tongue (English) or their foreign language (Spanish). Each decision was the same: receive US$1 or gamble for a 50/50 chance to get nothing or US$2.50. Given the higher expected value of the gamble (US$1.25) compared with the sure gain (US$1.00), these were beneficial bets. Although people using their native tongue took advantage of this opportunity only 54% of the time, those using a foreign language accepted the bets 71% of the time. Keysar and colleagues found a similar effect with native Korean speakers using English as a foreign language when they made hypothetical choices that involved risk. Using the Holt-Laury test (Holt & Laury, 2002), Costa, Foucart, Arnon, Aparici, and Apesteguia (2014) also found that people using a foreign language were less risk averse than those using their native tongue. These studies show that people are more likely to take risks when they use a foreign language than when using a native tongue. However, the risky decisions in these studies had higher expected values than the safe alternatives, making it unclear whether foreign language users were taking strategic risks or whether they were just taking more risks in general.

One could imagine two different accounts for the existing findings that people take more risks in a foreign language. The first is the *Indiscriminant Risk-Taking* account. This account predicts that people using a foreign language would take more risks in general, regardless of whether those risks are beneficial or not. Such an effect could arise from a number of processes such as an *increase in impulsivity* or a *decrease in risk perception*. A foreign language could increase impulsivity because it provides psychological distance and perhaps dulls the force of inhibitions that might typically make us risk averse. This could lead to more risk-taking regardless of the potential cost or benefit. Alternatively, people could be more willing to take risks in a foreign language because they perceive the risk as lower. Hadjichristidis, Geipel and Savadori (2015) found that describing potential hazards such as "biotechnology" led to greater perceptions of benefits and lower perceptions of risk in a foreign language relative to the native language. Yet, a third possibility is that the increase in cognitive load when using a foreign language could disrupt people's ability to make reasoned choices, leading to risk-taking that is not sensitive to expected value. Indeed, research has shown that greater cognitive ability is associated with higher sensitivity to expected value (e.g., Benjamin & Shapiro, 2005). As such, to the extent that using a foreign language reduces cognitive ability, we may expect less discriminating risk-taking behaviour relative to a native tongue. An increase in impulsivity, a decrease in risk perception, or a decrease in cognitive ability could predict that people using a foreign language would take more risks regardless of whether it was beneficial to do so or not.

The second possibility is what we term the *Strategic Risk-Taking* account. The emotional distance afforded by the foreign language may allow people to exercise more deliberative risk-taking. In the domain of losses, people using a foreign language may be less affected by the fear of sure losses that sometimes encourages people to take risks that are not beneficial. In the domain of gains, people using a foreign language may be less afraid of the possibility of losing a sure gain that sometimes prevents people from taking beneficial risks. This account would predict that people using a foreign language would take more risks when they are beneficial, but will take fewer risks when they are less beneficial than the safe alternative. We ran a series of four experiments to evaluate these two accounts of how using a foreign language could affect risk-taking. Figure 1 depicts the processes that could result in these patterns of risk-taking.

In addition to exploring these two potential accounts which may speak to the underlying mechanisms, a major goal of this investigation is to test the robustness of the effect across different populations and experimental designs. In particular, we considered the potentially moderating roles of participant language background, such as foreign language proficiency, age of acquisition (AOA), and immersion, as well as methodological features, such as minimum payment and ease of expected value calculation. Given that relatively little research has been conducted on

Table 1. Exclusions.

	Foreign at home	Non-native	Foreign dominant	Missing demographic	Technical issues	Comprehension	Other
Experiment 1	14	0	18	4	2	3	0
Experiment 2	31	0	6	0	0	3	13
Experiment 3	4	5	0	0	0	15	0
Experiment 4	0	0	23	0	0	2	0

Number of participants excluded from Experiments 1 to 4. Participants were excluded if they reported speaking the target foreign language at home, that the target native language was not their native language, that the target foreign language was dominant to the target native language, if they were missing critical demographic information, experienced technical issues, or failed the comprehension check. For Experiment 2, participants were additionally excluded if they attended an English language elementary school. This exclusion criterion differed from the other three experiments as Experiment 2 was conducted in Hong Kong where it is common for individuals to attend elementary school in the target foreign language (i.e., English).

Table 2. Demographic summary.

	Age	Age of acquisition	Native proficiency	Foreign proficiency
Experiment 1	37	18	6.8	4.7
Experiment 2	32	9	6.3	3.7
Experiment 3	20	12	7.0	4.8
Experiment 4	30	15	6.8	5.1

Demographic information including average age at the time of the experiment, age of foreign language acquisition, and proficiency scores for the native and foreign languages averaged across reading, listening, writing, and speaking on a scale from 1 to 7 (7 = *fully proficient*).

this phenomenon, it is critical to gain a more comprehensive picture of the effect's landscape so as to better understand the boundary conditions and potential impact.

General methods

Exclusions. Following the same exclusion criteria used in Keysar et al. (2012), participants were excluded if they reported that (a) the target native language was not their dominant language, (b) the target foreign language was their dominant language, or (c) they grew up speaking the foreign language at home. Participants were additionally excluded if they failed to answer critical demographic questions, experienced technical issues, or failed the comprehension checks that were administered at the end of the experiment. Specific exclusions for each study can be found in Table 1.

Demographics. At the end of the experiments, participants were asked to provide demographic information including current age, age of foreign language acquisition, and self-rated proficiency for reading, writing, speaking, and listening comprehension in both the native and foreign languages. Proficiency scales ranged from 1 to 7 with 7 indicating *full proficiency*. The four subscales were averaged to create a general index of proficiency in each language. A summary of demographic information for each experiment can be found in Table 2.

Procedures. In all experiments, participants were randomly assigned to complete the entire study, including all interactions with the bilingual experimenters as well as all materials, in either the native or foreign language. All non-English materials used in the experiments were translated and back translated to ensure comparability (Brislin, 1970). In Experiments 1 to 3, participants made a series of gambling decisions while seated across from the experimenter. A screen was placed between the experimenter and the participant to minimise experimenter influence. Experiment 4 involved a single decision and no screen was utilised. In all four studies, the experimenter used E-Prime 2.0 to keep track of the participants' decisions.

Experiment 1: Good versus bad bets in the domain of losses

In Experiment 1, we evaluated the question of whether people are generally more risk-seeking or more strategic when using a foreign language by presenting people with both good and bad bets. If the use of a foreign language simply increases risk-taking due to increased impulsivity or decreased perception of risks, then participants using a foreign language should take more risks than those using a native language, regardless of whether it is wise to do so. In contrast, if foreign language use promotes a more strategic approach to risk, then those using a foreign language should take more bets that are beneficial and fewer bets that are not beneficial.

Method

Participants. Our analysis included 239 native Polish speakers who spoke English as a foreign language. They resided either in the United States ($N = 142$) or in Poland

($N=97$). Participants were randomly assigned to do the task in the native language Polish ($N=117$) or the foreign language English ($N=122$). Participants were also randomly assigned to either the "Good Gamble" or "Bad Gamble" condition. This resulted in participants being assigned to one of four conditions: "Good Polish" ($N=57$), "Bad Polish" ($N=60$), "Good English" ($N=60$), or "Bad English" ($N=62$).

Procedure. We converted an experimental paradigm originally used in the domain of gains to the domain of losses (Keysar et al., 2012; Shiv et al., 2005). Participants in the United States were endowed with US$30 in small bills and coins, and participants in Poland were endowed with the equivalent amount in Polish Zloty (90 zł). They were informed that they would be playing 20 rounds of a game with this money, and that they would keep any money that was earned or left at the end of the game. For each round, they made a choice between paying US$1 (3 zł) and moving on to the next bet or flipping a coin for a 50/50 chance to either lose nothing or lose more than US$1. For each of the 20 identical bets, those in the "Good Gamble" conditions would lose US$1.50 (4.50 zł) if they lost the coin toss, making the expected value of the gambling option −US$0.75, which was better than paying US$1. Hence, these were beneficial bets. Those assigned to the "Bad Gamble" conditions stood to lose US$2.50 (7.50 zł) if they lost the coin toss. The expected value of this gambling option was −US$1.25, which was worse than paying US$1. Hence, it was beneficial to avoid these bets.

In each round, participants were asked whether they would like to pay or gamble. If they decided to pay, they gave the experimenter US$1 and moved on to the next round. If they decided to gamble, they called either "heads" or "tails" and flipped a digital coin using a phone app. If they won the bet they moved on to the next round without paying anything. If they lost the bet, they paid either US$1.50 or US$2.50 depending on whether they were in the good or bad gamble group, respectively.

Results

Language. Figure 2 shows the average percentage of bets taken. The results support the hypothesis that using a foreign language leads to strategic risk-taking. In their native tongue, participants took most of the bets regardless of whether they were beneficial (90%) or not (88%). In contrast, they were more discriminating in a foreign language, taking more beneficial (91%) than non-beneficial bets (76%). To assess the effect of language and bet condition on risk-taking, we performed a generalised linear mixed-effects analysis. The response variable was whether each of the 20 bets was taken or not. Language (native or foreign) and Bet Condition (good or bad) were entered as fixed effects, and Participant and Bet (1-20)

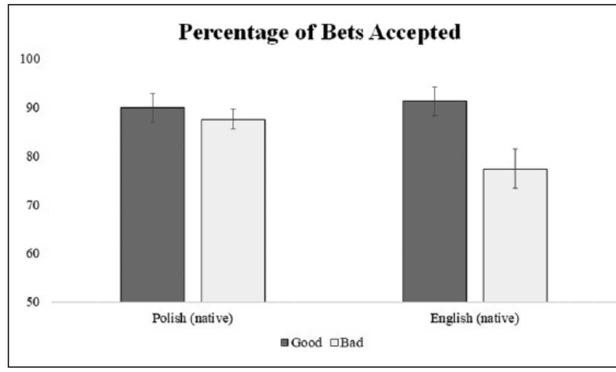

Figure 2. Average percentage of Good and Bad gambles accepted in the Native and Foreign language conditions in Experiment 1.

were entered as random effects with random intercepts and slopes without random correlations. There was a marginally significant main effect of language such that those using the foreign language took fewer bets overall than those using the native tongue (*M*s = 84% and 89%, respectively; $\chi^2(1, N=239)=3.03$, $p=.08$; $\beta=-0.53$, standard error [*SE*] = 0.31). There was also a significant main effect of condition such that overall, participants took a higher proportion of bets that were beneficial than those that were not ($\chi^2(1, N=239)=12.5$, $p<.001$; $\beta=0.91$, $SE=0.31$). Most importantly, there was a marginally significant Language × Bet Condition interaction such that those using the foreign language took 15 percentage points more Good bets than Bad ones, whereas only a 2 percentage points difference between conditions was observed when using the native language ($\chi^2(1, N=239)=3.6$, $p=.057$; $\beta=1.17$, $SE=0.62$).

These results suggest that using a foreign language increases sensitivity to expected value relative to using a native tongue, thereby promoting more strategic considerations of risk.

Experiment 2: Bad bets in the domain of losses

The *Indiscriminant Risk-Taking* account predicts that using a foreign language would lead to a general increase in risk-taking. The results of Experiment 1 are inconsistent with this prediction. Instead, using a foreign tongue actually decreased risk-taking for non-beneficial gambles, but not for beneficial ones, as the *Strategic Risk-Taking* account would predict. Previous research has demonstrated that using a foreign tongue increases risk-taking for beneficial bets in the domain of gains (Costa et al., 2014; Keysar et al., 2012), and as such, the novel finding here is that using a foreign language decreases risk-taking for non-beneficial bets in the domain of losses. Experiment 2 was conducted to test the robustness of this effect using a different language population of native Cantonese Chinese speakers in Hong Kong using English as a foreign language. In addition to serving as a replication, this experiment was conducted to ensure that prior effects were not specific to Polish as the native language and English as the foreign.

Method

Participants. Our analysis included 155 Cantonese-English bilinguals residing in Hong Kong. Participants were randomly assigned to complete the experiment in either their native language, Cantonese Chinese ($N = 73$), or their foreign language, English ($N = 82$).

Procedure. Participants were given 230 Hong Kong Dollars (about US$30) in small bills to gamble for 20 rounds. The gambling outcomes were analogous to those in the "Bad Gamble" condition in Experiment 1, as the bets presented were lower in expected value than the sure loss option. Each round, participants could choose to pay or gamble. If they chose to pay, they paid 8 Hong Kong Dollars (about US$1). If they chose to gamble, they called either "odd number" or "even number" and rolled a fair die using a phone app. If they won the bet, they moved on to the next round without paying anything. If they lost the bet, they paid 20 Hong Kong Dollars (about US$2.6). Participants were told that the money left at the end of the gambling game would be theirs to keep. Participants were also guaranteed a minimum payment of 50 Hong Kong Dollars (US$6.5) regardless of the results of the gambling game.

To ensure that participants understood the instructions, the participants answered comprehension questions about the rules before the game started. The experimenter corrected the participants if they made mistakes in those questions. Most participants were also presented with a tree diagram of the game outcomes in the assigned language, which served as a visual aid when the experimenter explained the rules. The diagram was added from the 67th subject on to make sure participants understood the instructions.

Results

Language. Participants in the Cantonese Chinese (native) condition took 74% of the bets and participants in the English (foreign) condition took 78% of the bets. To assess the effect of language (native vs foreign), we performed a generalised linear mixed-effects analysis. The response variable was whether each of the 20 bets was taken or not. Language was entered as a fixed effect with random intercepts for Subject and Bet. No significant effect of language was found ($\chi^2(1, N = 155) = 0.927$, $p = .33$; $\beta = 0.40$, $SE = 0.41$). There was a significant effect of Bet such that individuals took fewer bets towards the end of the sequence relative to the beginning ($\chi^2(1, N = 155) = 39.808$, $p < .001$; $\beta = -0.12$, $SE = 0.01$); however, this did not interact with Language ($\chi^2(1, N = 155) = 0.390$, $p = .532$; $\beta = 0.01$, $SE = 0.02$).

This experiment thus found no evidence that using a foreign language leads to more or less risk-taking. It did not replicate the results of Experiment 1's bad bet condition, and it is inconsistent with either the *Indiscriminant Risk-Taking* or *Strategic Risk-Taking* account.

Experiment 3: Good versus bad bets in the domain of gains versus losses

In contrast to Experiment 1 in which we found that using a foreign language decreases risk-taking for non-beneficial bets, Experiment 2 revealed no effect of language. Given the mixed results of these two experiments, we conducted Experiment 3 with three goals in mind: (a) to gather additional data to shed light on how using a foreign language affects non-beneficial bets in the domain of losses, (b) to test the effect with English as the native language, and (c) to more fully investigate the effect of using a foreign language in the domains of both gains and losses for gambles that were either beneficial or not. To do so, we adopted the same basic repeated-gambling paradigm from Experiments 1 and 2, but this time with a fully within-subject design in which all participants saw both good and bad bets in the domains of both gains and losses. Language remained a between-subject variable. If a foreign language leads to a general increase in risk-taking behaviour, we would expect those using a foreign language to accept more bets than those using their native tongue. This increase might be especially pronounced in the domain of gains in which people using their native language tend to be more risk averse (Kahneman & Tversky, 1979). On the contrary, if using a foreign language leads to a strategic approach to risk, we would expect different patterns of results depending on whether the bets are beneficial or not. More specifically, we would expect that in the domain of gains, in which people tend to be risk averse, those using a foreign language should accept more Good bets, but not more Bad bets. In the domain of losses, in which people tend to be risk seeking, we would expect those using a foreign language to accept fewer Bad bets, but not fewer Good ones.

Method

Participants. Data from 97 native English speakers who spoke Spanish as a foreign language were included in the analysis. All participants were residing in Chicago, IL, at the time of the experiment. Participants were randomly assigned to either the native English condition ($N = 50$) or the foreign Spanish condition ($N = 47$).

Procedure. The participant was endowed with US$45 in small bills and coins. Participants were informed that they could keep any money left at the end of the game. Participants completed four blocks, each with 15 gambles. Two blocks were in the loss domain and mirrored those used in Experiment 1. In these blocks, participants could either pay US$1.00 or else gamble by flipping a coin. If they won the coin toss, they would not lose any money, but if they lost the toss, they would lose some amount of money depending on the condition. In the Loss-Good condition, losing the coin flip resulted in a loss of US$1.50, which gave the gamble an expected value of −US$0.75. This gamble then has a higher expected value than paying US$1.00. In the Loss-Bad condition, losing the coin flip resulted in a loss of US$2.50, giving the gamble an expected value of −US$1.25. This has a lower expected value than paying US$1.00.

The other two blocks were in the gain domain. Participants needed to decide whether to keep US$1.00 or else gamble by flipping a coin. If they lost, they lost the dollar. If they won they either got US$1.50 (Bad) or US$2.50 (Good). Here again, one of the conditions involved a gamble that was more beneficial than taking the safe option, whereas the other did not. In this way, we had four conditions for each participant—two for which gambling was beneficial and two for which it was not, as well as two in the domain of gains and two in the domain of losses. The four blocks were presented in a fixed order: Loss-Bad, Loss-Good, Gain-Bad, and Gain-Good. Note that unlike in previous experiments, bet type was varied within-subject rather than between-subject. As such, the fixed order was established so that the first block would serve as an uncontaminated, direct replication of the Loss-Bad conditions from Experiments 1 and 2 while still allowing us to observe whether any language effects would emerge when expected value and domain were varied within subject.

Before beginning the task, participants read written instructions describing the game without specific information regarding the pay offs. Once the instructions were understood, the experimenter showed participants a card that had the specific parameters of the block written on it (see Figure 3 for example). The 15 rounds for that block then commenced. After 15 rounds, the experimenter showed the card for the next block and continued. Upon completion of the gambling task, the participant was asked to confirm how much money was remaining and told that they would be paid that amount at the end of the experiment.

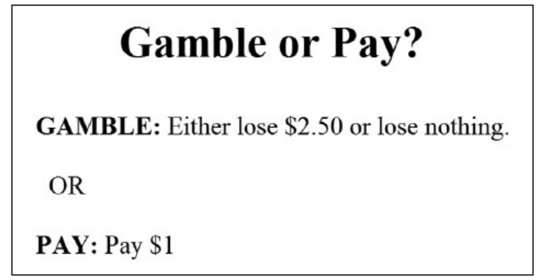

Figure 3. Example of card shown to participant that outlined the outcomes of one of the betting blocks, in this case, Loss-Bad in Experiment 3.

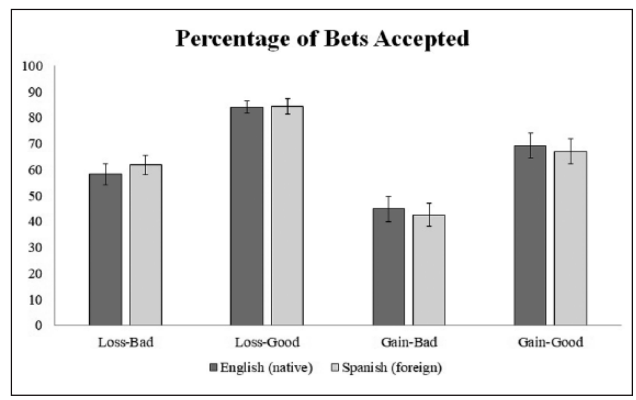

Figure 4. The average percentage of bets accepted out of 15 for each of the four bet conditions in Experiment 3.

Results

Language. Figure 4 shows the average percentage of bets taken. To assess the effect of language (native vs foreign), valence (good vs bad), and domain (gain vs loss) on risk-taking, we performed a generalised linear mixed-effects analysis. The response variable was whether each of the 60 bets was taken or not. Language was entered as a fixed effect, and Participant, Bet (1-15), Valence, and Domain were entered as random effects with random intercepts and slopes without random correlations. There was no main effect of Language, suggesting that using a foreign language did not lead to a general increase or decrease of risk-taking ($\chi^2(1, N=97)=0.117$, $p=.733$; $\beta=-0.09$, $SE=0.28$). There was a significant main effect of Valence such that people were more likely to accept Good bets than Bad bets ($\chi^2(1, N=97)=60.85$, $p<.001$; $\beta=1.97$, $SE=0.22$), but this did not interact with Language ($\chi^2(1, N=97)=0.406$, $p=.524$; $\beta=-0.21$, $SE=0.43$). In addition, consistent with prospect theory, people were significantly more likely to accept bets in the domain of losses than in the domain of gains ($\chi^2(1, N=97)=17.666$, $p<.001$; $\beta=-0.97$, $SE=0.22$), but this did not interact with Language ($\chi^2(1, N=97)=0.577$, $p=.448$; $\beta=-0.33$, $SE=0.43$). We find no evidence that people are more or less sensitive to valence depending on domain (Valence × Domain interaction; $\chi^2(1, N=97)=1.779$, $p=.182$; $\beta=0.22$, $SE=0.16$), nor was there a Language × Valence × Domain interaction ($\chi^2(1, N=97)=0.240$, $p=.624$; $\beta=-0.16$, $SE=0.31$). Contrary to past results in previous literature as well as

Experiment 1, we find no evidence that using a foreign language leads to more or less risk-taking.

Experiment 4: A bad bet in the domain of losses

Experiments 1 to 3 have yielded a mixed set of results regarding the effect of using a foreign language on risk-taking behaviour. One possibility is that the effect of language is not robust enough to persist across multiple decisions. In all previous experiments, participants were asked to make the same basic choice many times, ranging from 20 to 60 times. Given that the actual amount of language used during the task is minimal, it may be that the effects of using a foreign language are more easily eroded in such language-poor repeated-gambling situations (e.g., Winskel, Ratitamkul, Brambley, Nagarachinda, & Tiencharoen, 2016). To test this hypothesis, we ran another study with a group of native Polish speakers who spoke English as a foreign language and asked them to make one gambling decision. This gamble was in the domain of losses and had a lower expected value relative to the safe alternative.

Method

Participants. Our analysis included 197 native Polish speakers who spoke English as a foreign language. They resided either in the United States (N=54) or in Poland (N=143). Participants were randomly assigned to do the task in the native language Polish (N=102) or the foreign language English (N=95).

Procedure. The main task of this experiment was a single choice whether to gamble or not. To make the decision consequential, we wanted to make sure that participants treated the money as their own. Before the gamble, participants earned the money by performing an unrelated task in which they answered 15 trivia questions. They were informed that their payment would be contingent on the number of correct solutions, but in reality everyone received the same amount of US$40 or 160 zł. Before completing the trivia task, participants were informed that they may not be able to keep all of the money that they earned. After earning the money, participants had a choice between paying the experimenter US$30 (120 zł), leaving them with US$10 (40 zł) for sure, or taking a gamble for a 1/6 chance to win an additional US$10 (40 zł) or else lose everything. If participants decided to gamble, they were asked to choose a number from 1 to 6 and then rolled a six-sided die. If the number they guessed came up, they would gain the extra US$10 (40 zł), but otherwise they would lose everything. Given that the expected value of gambling (US$8.33) was less than that of paying the money (US$10), it would be beneficial to avoid taking this risk.

Results

Language. The results are consistent with the *Indiscriminant Risk-Taking* account. A simple chi-square test revealed that those using the foreign language were marginally more likely to accept the non-beneficial gamble with 69.6% of those in the foreign language condition accepting the gamble as compared with 62.8% in the native language ($\chi^2(1, N=197)=3.28$, $p=.070$, $\varphi=.129$). These data suggest that using a foreign language may increase risk-taking in general. In other words, the data from Experiment 4 support the *Indiscriminant Risk-Taking* account, instead of the *Strategic Risk-Taking* account, as suggested by Experiment 1.

Participant language background as a potential moderator

We explored whether features of the participants' language background moderated the effect of language on risk in all four experiments. There were three factors we focused on: foreign language proficiency, AOA of the second language, and immersion.

Within experiments

Proficiency. As can be seen in Table 3, we observed no significant main effects of proficiency and no significant interaction between proficiency and language on risk-taking within any of the four experiments. In Experiments 1 and 3, we also observed no significant interaction of proficiency, language, and expected value on risk-taking (recall that expected value was not a factor in Experiments 2 and 4). It should be noted, however, that we purposefully recruited participants with an intermediate level of proficiency and as such, the present results do not reflect the full spectrum of potential foreign language competence.

AOA. We observed no significant main effects of AOA and no significant interactions between AOA and language on risk-taking in Experiments 1, 3, and 4, as can be seen in Table 4. In Experiment 2, the main effect of AOA was marginally significant ($\beta=0.07$, $SE=0.04$, $p=.097$). Interactions of AOA, language, and expected value on risk-taking were also non-significant in Experiments 1 and 3. Note that participants with intermediate-level proficiency had been specifically recruited for the study, so our samples mainly consisted of late learners of their second language.

Location. In Experiments 1 and 4, experiments were conducted in both Poland, a native language context, and the United States, a foreign language context. The level of foreign language immersion is higher in the United States than in Poland, because Polish-English bilinguals are surrounded daily by English-speaking people and English media. In Experiment 1, study location had no significant

Table 3. Effects of proficiency.

Study	Proficiency				Proficiency × Language				Proficiency × Language × Expected Value			
	χ^2	*p* value	β	*SE*	χ^2	*p* value	β	*SE*	χ^2	*p* value	β	*SE*
1	0.01 (*N* = 239)	.939	–0.01	0.12	1.93 (*N* = 239)	.165	0.34	0.25	1.09 (*N* = 239)	.297	–0.51	0.49
2	1.04 (*N* = 155)	.308	–0.18	0.17	0.38 (*N* = 155)	.54	–0.22	0.34	n/a			
3	0.04 (*N* = 97)	.851	0.03	0.16	0.65 (*N* = 97)	.421	–0.26	0.31	1.08 (*N* = 97)	.298	0.51	0.48
4	1.93 (*N* = 197)	.164	0.22	0.16	0.01 (*N* = 197)	.919	–0.03	0.33	n/a			

SE: standard error.
Results of assessing the effects of proficiency, language, and expected value on risk-taking.

Table 4. Effects of age of acquisition (AOA).

Study	AOA				AOA × Language				AOA × Language × Expected Value			
	χ^2	*p* value	β	*SE*	χ^2	*p* value	β	*SE*	χ^2	*p* value	β	*SE*
1	0.24 (*N* = 239)	.624	–0.08	0.02	2.48 (*N* = 239)	.108	0.69	1.22	0.09 (*N* = 239)	.756	0.02	0.07
2	2.76 (*N* = 155)	.097	0.07	0.04	1.32 (*N* = 155)	.252	–0.1	0.09	n/a			
3	1.08 (*N* = 97)	.298	0.04	0.04	3.16 (*N* = 97)	.75	0.15	0.08	0.02 (*N* = 97)	0.883	–0.08	0.05
4	1.19 (*N* = 196)	.275	0.01	0.01	0.27 (*N* = 196)	.601	–0.01	0.03	n/a			

SE: standard error.
Results of assessing the effects of age of acquisition (AOA), language, and expected value on risk-taking.

Table 5. Effects of location.

Study	Location				Location × Language				Location × Language × Expected Value			
	χ^2	*p* value	β	*SE*	χ^2	*p* value	β	*SE*	χ^2	*p* value	β	*SE*
1	1.19 (*N* = 239)	.276	–0.33	0.3	3.88 (*N* = 239)	.089	1.03	0.61	0.01 (*N* = 239)	.916	0.13	1.22
2	n/a				n/a				n/a			
3	n/a				n/a				n/a			
4	4.56 (*N* = 197)	.032	–0.79	0.38	0.42 (*N* = 197)	.516	0.51	0.78	n/a			

SE: standard error.
Results of assessing the effects of location, language, and expected value on risk-taking.

main effect on risk-taking, as can be seen in Table 5. There was a marginal Location × Language interaction such that the overall increase in risk-taking when using a native language was marginally greater in the United States (native–foreign = 1.44 bets) than in Poland (0.06 bets; $\chi^2(1, N=239)=3.88$, $p=.089$; $\beta=1.03$, $SE=0.61$). However, the interaction of location, language, and expected value was non-significant, suggesting that this increase in native language risk-taking in the United States did not differ between good and bad bets. In Experiment 4, we observed a significant effect of location on risk-taking ($\beta=-0.79$, $SE=0.381$, $p=.032$), such that participants residing in Poland at the time of the experiment gambled less than those residing in the United States. The interaction of location and language was non-significant, meaning that location did not moderate the effect of language on risk-taking.

Across experiments. Although neither proficiency nor AOA were significantly predictive of risk-taking within experiments, we explored whether these factors may shed some light on differences found across experiments. To reduce variability introduced by methodological differences between studies, we limited our analysis only to blocks and experiments involving bad gambles in the domain of losses. As such, we excluded the good gamble condition from Experiment 1 as well as the good gamble and gain conditions from Experiment 3. For the remaining blocks and experiments, we calculated *Z*-scores of gambling behaviour within each experiment to standardise the measures across studies.

Effects of language on risk. We first explored whether the effect of language on risk-taking varied across experiments by running a univariate analysis of variance (ANOVA) with the standardised risk score as the dependent variable and language and experiment as fixed factors. There were no main effects of language ($F(1, 563)=.02$, $p=.884$) or experiment ($F(3, 563)=.002$, $p>.9$), but there was a significant Language × Experiment interaction (F(3, 563) = 3.17, p = .024). This reflects the finding that foreign language users in Experiment 1 accepted fewer of these bad bets relative to native language users, whereas the pattern was directionally reversed in the remaining three studies, with marginal significance in the case of Experiment 4.

Proficiency. We first compared overall levels of proficiency across experiments and found that they significantly differed from each other (F(3, 556) = 71.11, p < .001). As can be seen in Table 2, the native Polish participants in Experiments 1 and 4 were the most proficient, followed by the native English speakers in Experiment 3. The native Cantonese speakers from Experiment 2 were the least proficient in the foreign language. Controlling for experiment, we find that foreign language proficiency marginally moderates the effect of language on risk-taking (β = −0.12, SE = 0.07, p = .084). The conditional effect of language on risk-taking was marginal for participants with proficiency scores 1 standard deviation below the mean, with native speakers taking fewer risks than foreign speakers (β = 0.21, SE = 0.12, p = .088). Conditional effects were not significant for those at or above the mean (p > .45). This provides marginal support for the *Indiscriminant Risk-Taking* account when participants are relatively less proficient in the foreign language.

AOA. AOA significantly differed across experiments (F(3, 547) = 25.61, p < .001). As can be seen in Table 2, the native Polish participants in Experiment 1 began acquiring the foreign language latest (M = 18 years old), whereas the native Cantonese speakers in Experiment 2 acquired it the earliest (M = 9 years old). It is of note that this pattern directly mirrors that of proficiency, such that the participants with the highest level of proficiency were the latest to acquire the language. However, there was no significant correlation between proficiency and AOA (r = .026, p = .542). Controlling for experiment, we find no evidence that AOA moderates the effect of language on risk-taking (β = −0.02, SE = 0.01, p = .126).

General discussion

Four experiments present mixed results regarding the impact of using a foreign language on risk-taking. Experiment 1 found that in the domain of losses, people take the same number of beneficial bets regardless of language, but take marginally fewer non-beneficial bets in a foreign language. This provides support for the *Strategic Risk-Taking* account. Experiment 2 compared the tendency to take non-beneficial risks in the domain of losses and found no difference between native and foreign language use. Experiment 3 compared risk-taking in both the domain of losses and the domain of gains, for beneficial and non-beneficial bets and found no difference between native and foreign language users. Finally, Experiment 4 found a marginal tendency to take more risks in the domain of losses with a foreign language compared with a native tongue. Given that the risks were non-beneficial, having an expected value lower than the non-risky alternative, these findings support the *Indiscriminant Risk-Taking* account.

We explored the robustness of the effect by examining whether the language background of the participants moderates the results. We observed that AOA did not reliably interact with the effect of language. Aggregate data from all four experiments suggest that foreign language proficiency did have a marginal moderation effect, suggesting that at lower levels of proficiency, foreign language may increase indiscriminant risk-taking. The *Indiscriminant Risk-Taking* account suggests that foreign language may increase risk-taking because the emotional distance conferred can lower inhibitions that typically make people risk-averse. However, given that the effect was marginal and inconsistent across experiments, this result should be interpreted with caution. Location appears to moderate risk-taking as well, yielding significant main effects in Experiment 4 and a marginally significant interaction of location and language in Experiment 1. This suggests that immersion in a second language context can influence risk-taking, though more studies are needed for a more systematic understanding of its moderating effects. Future studies should sample from a larger range of language backgrounds to better understand the robustness of the foreign language effect on risk.

We also considered whether methodological differences across experiments could account for the inconsistent results. Given that the populations for Experiments 1 and 4 were very similar (native Polish speakers residing in either the United States or Poland), the discrepant results between those two studies are likely due to the experimental design rather than the population. The two experiments varied in at least two respects. First, Experiment 1 involved multiple small gambles, whereas Experiment 4 involved a single, larger gamble. However, Experiments 2 and 3 also involved multiple small gambles and showed no effect of language. As such, it is unlikely that this feature alone could account for why we see strategic risk-taking in one case and indiscriminant risk-taking in the other.

A second difference is that the expected value calculation for Experiment 1 (50/50 chance of either losing US$2.50 or nothing) was relatively easier than for Experiment 4 (one in six chance of either winning an extra US$10 or losing US$40). As such, one could argue that using a foreign language leads to strategic risk-taking only when it is simple enough to determine the normative course of action. However, just as with the previous point, Experiments 2 and 3 had a similar design as Experiment 1, making this inference less plausible.

As noted, Experiments 1 through 3 shared many design features. All three experiments involved multiple small gambling decisions and a condition that involved bad bets in the domain of losses. Although Experiment 3 varied bet-type within-subject rather than between-subject, the bad bets in the domain of losses were presented first, making it a comparable analogue to the bets in Experiments 1 and 2. Some methodological differences did exist, however, such as that participants in Experiment 2 were promised a minimum payment, whereas those in Experiments 1 and 3 were not. This minimum payment may have made the task feel less risky in general, thereby eliminating a potential reduction in risk from using a foreign language because of floor effects. This account does not, however, explain why no language effect emerged for Experiment 3 for which no such minimum payment was promised.

Given that the four studies varied across multiple dimensions, it is not possible to conclusively isolate one methodological feature that moderates the foreign language effect on risk. In addition, the experiments also varied on dimensions other than methods, including culture and language backgrounds. Although we cannot pinpoint a single element that can account for the discrepant results we found across experiments, this series of studies does give us a glimpse into potential boundary conditions and suggests that the effect of language on risk is not particularly robust across multiple different contexts and populations. To allow for a broader evaluation of this issue, we provide a more comprehensive summary of the relevant results across papers reported in the literature as well as in this article. In Table 6, we present effect sizes, *p* values, and sample sizes for seven experiments investigating the foreign language effect on risk, including those reported in this article. As can be seen, the effect of using a foreign language on risk appears to be highly variable. In eight of these 12 comparisons, we observe an increase in risk-taking, with three significant comparisons (Experiment 4 in this article and Keysar et al., 2012; Experiments 2 and 3). In four of the 12, we find a foreign language decrease in risk-taking, with two comparisons yielding significant differences (Experiment 1 in this article and Costa et al., 2014; Experiment 3a). The results suggest that foreign language use does not consistently increase risk-taking, thereby casting doubt on the *Indiscriminant Risk-Taking* account.

But does foreign language use lead to more strategic risk-taking? We observe that foreign language use increased the likelihood of taking good bets in five of six comparisons. Two comparisons yielded significant results, and they both used good bets in the domain of gains (Keysar et al., 2012; Experiments 2 and 3). In one comparison, foreign language use decreased the likelihood of taking good bets, but the results were not significant (Experiment 3 in this article). The direction of most comparisons suggests a weak trend that foreign language may

Table 6. Overview.

Study	Native	Foreign	Losses				Gains			
			Beneficial		Not beneficial		Beneficial		Not beneficial	
			d (*N*)	*p* value	*d* (*N*)	*p* value	*d* (*N*)	*p* value	*d* (*N*)	*p* value
Experiment 1	Polish	English	.04 (*N* = 117)	.821	−.44 (*N* = 121)	.017				
Experiment 2	Chinese	English			.12 (*N* = 155)	.33				
Experiment 3	English	Spanish	.03 (*N* = 97)	.82	.08 (*N* = 97)	.64	−.07 (*N* = 97)	.75	−.11 (*N* = 97)	.58
Experiment 4	Polish	English			.31 (*N* = 197)	.07				
Keysar et al. (2012); Experiment 2	Korean	English					.44 (*N* = 146)	.008		
Keysar et al. (2012); Experiment 3	English	Spanish					.55 (*N* = 54)	.038		
Costa et al. (2014); Experiment 3a	Spanish	English					.10 (*N* = 300)	.542	−.29 (*N* = 300)	.027*

Effect sizes, sample sizes, and *p* values for seven foreign language risk studies. For Experiment 4 and Costa et al. (2014), effect sizes were based on the proportion of subjects accepting a single gamble. In these cases, the log odds ratio was calculated and then converted to Cohen's *d*. For all other experiments which involved multiple gambles, effect sizes were calculated from the mean proportion of gambles accepted. In most cases, participants were presented with choices between either taking a gamble or not (risky option or safe option). Bets were classified as either "beneficial" or "not beneficial" depending on whether the expected value of the risky option was greater than that of the safe option. Unlike in the rest of the experiments, Costa et al.'s (2014) participants were presented with a series of choices between two gambles that varied in expected value (risky option A or risky option B). We calculated the effect of language for the two consecutive pairs of bets for which the optimal choice flipped (A dominated B for Bet 4 and B dominated A for Bet 5). Using the choice of option A as the reference point, we classified Bet 4 as a "beneficial" bet and Bet 5 as a "not beneficial" bet. Positive Cohen's *d* scores reflect the foreign language taking more bets.

increase the likelihood of taking good bets. However, most of these comparisons were not statistically significant.

In studies that examined bad bets, we observe that foreign language use decreased risk-taking in three of six comparisons. There were two comparisons that yielded significant results, with one from the loss domain and one from the gain domain (Experiment 1 from this article and Costa et al., 2014; Experiment 3a, respectively). Foreign language use made people take more bad risks in the remaining three comparisons, with one comparison yielding marginally significant differences (Experiment 4 in this article). Overall, using foreign language does not seem to consistently decrease the likelihood of taking bad bets. Taken together, we do not find strong support for the *Strategic Risk-Taking* account.

Conceptual issues

Overall, the effect of language on risk-taking is unclear. We predicted that foreign language use may increase impulsivity or lower perceptions of risk, thus encouraging people to take more risks regardless of expected value. However, neither of these processes which would result in indiscriminant risk-taking was supported by the evidence. Alternatively, we predicted that using a foreign language may increase strategic risk-taking, because the emotional distance conferred by a foreign language may allow people to become more sensitive to the expected values of risky options. However, the existing evidence did not consistently support the *Strategic Risk-Taking* account.

Methodological issues

The inconsistent results could suggest that risk-taking is not systematically influenced by the native-ness of a language. However, our inconclusive results could also be due to methodological limitations. In particular, our prediction is that foreign language influences risk-taking through emotional distance. To avoid a floor effect, the emotionality of the bet must be sufficiently high in a native language to allow room for emotional attenuation in a second language. However, many participants expressed that the experiment felt like a game, suggesting that they did not find the gambles consequential. Why might this be? Participants are gambling with small sums of money that have little impact on their total wealth, and the money used was endowed to the participants during the course of the experiment rather than their own money prior to the study. This suggests that participants may not have taken the gambles very seriously. The baseline emotionality of the bet may have been too low to demonstrate emotional attenuation from a foreign language.

Although gambles were presented in the assigned language, the evaluation of gambles was not particularly linguistic. In particular, a strategic evaluation of a gamble simply involves a calculation of expected values devoid of language. The lack of language richness in the gambling paradigm may have reduced the strength of the language manipulation. Compare this with Hadjichristidis et al.'s (2015) study, which found that using a foreign language decreased perceptions of risk and increased perceptions of benefit in hazards such as "biotechnology". In the absence of numerical risk assessments, participants would rely more on semantic associations triggered by the stimuli, a process that is more closely linked to language than the calculation of expected value in our studies. Indeed, such a result would be consistent with recent findings by Winskel et al. (2016) who discovered that people using a foreign language demonstrated reduced framing effects for language-rich tasks, but not for a relatively language-poor variant.

Future directions

Future research might try to reconcile these mixed findings of the role of language in risk-taking. To address limitations of this study, researchers could make sure that participants are emotionally invested in the risky decision, and that the decision is sufficiently language-rich. Furthermore, the role of language on risk-taking is likely influenced by context, such as whether the risk is passive or active (e.g., not wearing a seatbelt versus speed-driving), the domain of risks (e.g., financial and health), and culture. Future studies should identify moderators that may also help explain the inconsistency of the current findings with previous research demonstrating that using a foreign tongue increases risk-taking.

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Author contribution

All authors contributed to developing the study concept and design. S.H. and B.K.Y.L. performed the data analysis and interpretation under the supervision of B.K. S.H., B.K., and B.K.Y.L. drafted the manuscript, and A.C. provided critical revisions. All authors approved the final version of the manuscript for submission.

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References

Benjamin, D., & Shapiro, J. (2005). Does cognitive ability reduce psychological bias? *Journal of Economic Literature*, J24, D14, C91.

Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, *1*, 187–216. doi:10.1177/135910457000100301

Costa, A., Foucart, A., Arnon, I., Aparici, M., & Apesteguia, J. (2014). "Piensa" twice: On the foreign language effect in decision making. *Cognition*, *130*, 236–254. doi:10.1016/j.cognition.2013.11.010

Hadjichristidis, C., Geipel, J., & Savadori, L. (2015). The effect of foreign language in judgments of risk and benefit: The role of affect. *Journal of Experimental Psychology: Applied*, *21*, 117–129. doi:10.1037/xap0000044

Haigh, M. S., & List, J. A. (2005). Do professional traders exhibit myopic loss aversion? An experimental analysis. *Journal of Finance*, *60*, 523–534. doi:10.1111/j.1540-6261.2005.00737.x

Harris, C. L., Aycicegi, A., & Gleason, J. B. (2003). Taboo words and reprimands elicit greater autonomic reactivity in a first language than in a second language. *Applied Psycholinguistics*, *24*, 561–579. doi:10.1017/S0142716403000286

Holt, C. A., & Laury, S. K. (2002). Risk aversion and incentive effects. *American Economic Review*, *92*, 1644–1655. doi:10.1257/000282802762024700

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist*, *58*, 697–720. doi:10.1037/0003-066X.58.9.697

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*, 263–292. doi:10.2307/1914185

Keysar, B., Hayakawa, S. L., & An, S. G. (2012). The foreign-language effect thinking in a foreign tongue reduces decision biases. *Psychological Science*, *23*, 661–668. doi:10.1177/0956797611432178

Pavlenko, A. (2005). *Emotions and multilingualism*. New York, NY: Cambridge University Press. doi:10.1017/CBO9780511584305

Rabin, M., & Thaler, R. H. (2001). Anomalies: Risk aversion. *Journal of Economic Perspectives*, *15*, 219–232. doi:10.1257/jep.15.1.219

Shenhav, A., & Greene, J. D. (2010). Moral judgments recruit domain-general valuation mechanisms to integrate representations of probability and magnitude. *Neuron*, *67*, 667–677. doi:10.1016/j.neuron.2010.07.020

Shiv, B., Lowenstein, G., Bechara, A., Damasio, H., & Damasio, A. (2005). Investment behavior and the negative side of emotion. *Psychological Science*, *16*, 435–439. doi:10.1016/j.tics.2005.02.002

Winskel, H., Ratitamkul, T., Brambley, V., Nagarachinda, T., & Tiencharoen, S. (2016). Decision-making and the framing effect in a foreign and native language. *Journal of Cognitive Psychology*, *28*, 427–436. doi:10.1080/20445911.2016.1139583